

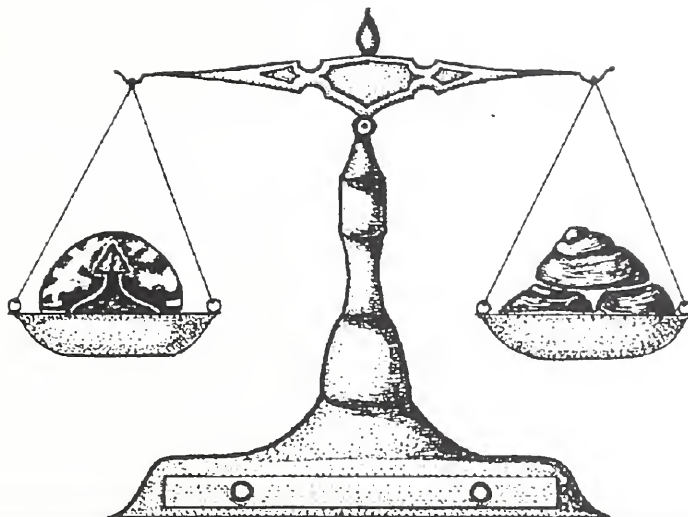
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The Scale



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EDITOR'S NOTES

During the meetings in Israel last summer it was decided that the mailing list for "The Scale" should be updated to include Fax numbers and E-mail addresses where ever they are available. From my own experience I have found that communication using either of these avenues greatly expedites contact with colleagues and may in the end be less expensive than letters in the mail.

Therefore, please fill out the following form and send it to me at the above address. I will gladly accept Faxes or E-mail communications also. **NB: YOUR NAME WILL BE REMOVED FROM THE MAILING LIST IF YOU DO NOT RESPOND BEFORE THE NEXT "SCALE" IS PUBLISHED IN DECEMBER OF 1995.**

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RICHARD F. WILKEY

A symposium was held in honor of Dick Wilkey at the National Meetings of the Entomological Society of America in Dallas Texas on December 14, 1994. The symposium included papers about all sternorrhynchous groups including scale insects, aphids, whiteflies, and psyllids. In all there were 10 papers. The first presentation was by Dug Miller and John Davidson recognizing the contributions of Dick Wilkey. The contents of that paper are given here as a permanent record of the many achievements of a truly remarkable human being.

Richard F. Wilkey: Entomologist and microscope preparator par excellence

It is a genuine pleasure to have the opportunity to recognize a person of the caliber and importance of Richard F. Wilkey. His contributions are not confined to entomology alone, but it is in this discipline that he leaves a legacy that will be recognized for generations to come.

I think I hear a murmur among some of the attendees of the symposium this evening, something to the effect of "well if this person is so important and is impacting my science today, why haven't I heard of him?" I guess it is precisely this point that has caused John Davidson and myself to have so much enthusiasm about recognizing Dick Wilkey. His contributions are not of the traditional type and they are not highly visible, but they are enormously important and probably are far more permanent than most of the traditional contributions that we all make. Richard has received very little recognition for his entomological accomplishments but if a careful analysis is made, we think that you will agree that he deserves all of the accolades that we can give.

Richard Wilkey was born August 14, 1925 in Providence, Rhode Island and moved to Indianapolis, Indiana when he was 12. He first became interested in insects when he made his first butterfly collection at the age of 6, but really got the bug so to speak when he moved to Indianapolis. He was a born taxonomist and during his career collected almost everything under the sun. In addition to his extensive collections of insects and other arthropods he has collected old books, fishing lures, Macdonald's paraphernalia, fountain pens, bottle and can openers, and sports cards used for food promotions, to name a few.

Like many aspiring young taxonomists Richard couldn't get enough of the variety and diversity of insects and even today is excited by the new discoveries that he makes near his home. He spent three years in World War II in the Pacific Campaign and returned to his entomological interests after the war. In 1950 he received his Bachelor's Degree in entomology at Purdue University and in 1951 completed his Master's Degree at Colorado State University. It was during this period that he developed his life-long interest in microscopic organisms and their preparation. While still at Purdue he became intrigued with the Collembolla and did an undergraduate project on the subject. His Master's thesis continued in this vein

as an analysis of the springtails of Larimer County, Colorado. In later years, when it was obvious that he would focus his energies on groups other than springtails, he turned over his collection to Ken Christensen including nearly 50 undescribed species, and 10 or 12 new genera.

He began his professional career in 1951 with the Mexican Cotton Company in Baja California working on pests of cotton. Later that year he was hired by the Santa Clara County Department of Agriculture in California where he worked for a year. He then was promoted and moved to San Diego for three years where he did quarantine identifications. In Sacramento, he finally obtained the job that he wanted most as the taxonomist responsible for identification of all Homoptera except aphids for the State of California.

During his tenure in this position he became recognized world wide for his knowledge of scale insect systematics. He often helped colleagues in other states such as Florida, Washington, and Arizona with especially difficult identifications and he served as the point person for visitors working with the "Ferris-McKenzie" scale collection at the University of California at Davis after the death of Howard McKenzie. After a distinguished career with the California Department of Agriculture, in 1971 he took an early retirement to escape the rigors and strain of living in a big city and returned to the small town atmosphere of Bluffton, Indiana. He started Arthropod Slidemounts, which was a mail order business to supply arthropods of various kinds to clientele who needed a diverse array of well prepared specimens. The primary clientele were high schools and colleges but he frequently provided specimens at a nominal fee for Extension short courses, Pest Control Operator training, the food industry, and 4-H programs. Last week he told me of providing the Koebeler Company with identifications and dry mounts of food pests that they might encounter. His nominal payment in this case was pretzels and cookies. He also developed a set of tools for micro-manipulation of specimens under the dissecting microscope, which are unquestionably the best that I have ever used. After another 20 year career, in 1991 he retired and sold his business to BioQuip Products.

Richard F. Wilkey can be characterized as an energetic, enthusiastic, and caring human being who is most comfortable working behind the scenes. Within entomology it is difficult to pick one area among his many accomplishments as the most important, and when consideration is given to his commitment to entomology in 4-H, and his leadership in other community activities the choice becomes impossible.

We suspect that after all is said and done, the nearly 1,000,000 perfect or nearly perfect microscope slide mounts that Richard has prepared will be the accomplishment that will have the most permanent and important impact. Certainly in our own research it is the Wilkey preparations that we seek out whenever available. With them it is easy to correctly ascertain the position and

structure of the various morphological features and make accurate determinations, illustrations, and descriptions. Unfortunately, poor or even average preparations can be the cause of inaccurate research not to mention the anguish and aggravation required to mentally manipulate specimens so that they are usable. In a recent conversation he indicated that he had made every mistake possible in preparing microscope slide mounts and it may be this experience that allowed him to improve the techniques that had been used previously. Certainly Richard is never afraid to experiment and it is this attitude that has allowed him to develop what is often called the Wilkey techniques. His procedures are currently used internationally and even today he is well known among coccidologists and frequently is asked for advice concerning the preparation of particularly difficult scale insects.

The largest concentrations of Wilkey slides are in the collections of the California Department of Food and Agriculture in Sacramento and The Bohart Museum at the University of California at Davis. Actually, I was especially privileged when I studied at Davis to have Richard make all of the preparations of the thousands of specimens that I collected for the mealybug book of Howard McKenzie and for my research on eriococcids. I guess that I was spoiled since I have never really learned to make more than a mediocre slide mount. Richard also took on the task of mounting the dry type material of Gordon Floyd Ferris and distributed it to the major museums of the world. This material is especially useful since it is of a much higher quality than the preparations made by Ferris and is present in collections such as the Smithsonian's National Coccoidea Collection at Beltsville, Maryland and The Natural History Museum in London where only limited Ferris material was available for study.

Richard also continues to have a very significant role as a teacher, not only in the capacity of helping others learn his slide mounting techniques, but also as an individual who has used his broad entomological knowledge and extraordinary enthusiasm to encourage hundreds of 4-H'ers to learn about insects. He has participated in and been a behind-the-scenes coorganizer of all seven of the Coccidology short courses at the University of Maryland and in this role has taught more than 100 students from all over the world how to properly mount scale insects. He has been involved in 4-H for at least 40 years and during that time has taught more than 400 students about insects of all sorts. Through his teaching and enthusiasm, approximately 10 of these students have pursued careers in entomology. Recently, in recognition of contributions to 4-H and the community, he and his wife Dorothy were chosen as the Grand Marshals of the Wells County 4-H parade one of the most important annual affairs in the Wells County area.

In addition to his work with 4-H, he has generously given of his time as a volunteer in the library and recycling center, and has served on the board of the Wells County Crippled Society, the River-greenway Committee, the Library Formation Committee, and the Park Board. In recognition of his many volunteer activities he was

recognized as the Wells County Citizen of the Year in 1994.

Richard currently is fighting the battle of his life with bone cancer. He recently fell and broke his arm and badly bruised his hip. For any normal person this would be totally debilitating, but not for Richard. I spoke to him last week, and he is up and around with a walker. He is working with several 4-H'ers on their insect projects, continues to make micro tools for BioQuip, and is working on several arthropod dry mount orders.

In conclusion, Richard F. Wilkey is the best micro Arthropod preparator in the U.S. He has left approximately 1,000,000 beautiful slide preparations for current and future generations of entomologists to study. His teaching abilities have given our discipline 10 professional entomologists from the ranks of 4-H programs and many more insect enthusiasts. His slide mounting techniques are used world wide. Finally and most importantly he is an inspiration for all that know him. For these things and many many more we recognize Richard F. Wilkey as an outstanding entomologist and colleague.

MCKENZIE BOOK ON SALE

Mealybugs of California, by Howard McKenzie is on sale at Edward R. Hamilton, Bookseller, Falls Village, CT 06031-5000, USA. The price is \$9.95 plus \$3.00 for handling. This is a very good price for a book that has many color plates and covers a significant percentage of the pseudococcid species of the United States.

BOOK REVIEWS

I have recently been asked to review the two catalogues produced by Yair Ben-Dov over the past two years. If you have not had the opportunity to look at them, you very much need to do so. They are fantastically valuable resources for anyone working on scale insects. The first book is: Ben-Dov, Y. 1993. A systematic catalogue of the soft scale insects of the World. Sandhill Crane Press, Inc. Gainesville, Florida, 536 pp. This catalog includes all of the soft scales or Coccidae described between 1758 and 1991 and encompasses 162 genera and 1090 species or subspecies. Treatment of genera and species are surprisingly detailed. For each genus there are four sections, i.e., the valid name and its author; a list of synonyms including such things as misspellings, homonyms, replacement names, etc., and any changes in rank; the type species and its method of designation; and a remarks section that provides: 1) references where generic characters are discussed, 2) references to keys, 3) a discussion of subjective synonyms, 4) discussion of nomenclatural history. Species group names each include the following sections: Species or subspecies name and author; synonyms; type data; geographical distribution; host plants; remarks; biology; and economic importance. In the type data section much valuable information is provided on the location of the type specimen(s). Geographical information is provided by country and zoogeographical region. Host data are given to the generic level organized alphabetically by family. The remarks section provides references on the following: common name of cosmopolitan and pestiferous species; redescriptions and illustrations of the various instars; photographs and SEMs; other aspects of morphology; nomenclatural discussions and decisions; anatomy and histology; cytology; chemistry; records of distribution and hosts. A separate biology section gives a brief discussion on the life history and ecology of the species along with pertinent references. The final section presents information on the economic importance of the species with references. General sections of the book include indices to species group names and genus group names, a complete list of references, a list of depositories, a discussion of higher level classification, a list of suprageneric group names, a listing of the pertinent opinions of the International Commission on Zoological Nomenclature, *Nomina Nuda*, and a section that provides biographical data on deceased coccidologists who described taxa within the Coccidae. A particularly useful general section provides references that are comprehensive publications on the family Coccidae on subjects such as general morphology of adult females, general morphology of adult males, general morphology of first instars, structure of wax glands, keys to genera, checklists, bibliographies, and others.

The second book is: Ben-Dov, Y. 1994. A systematic catalogue of the mealybugs of the World. Intercept Ltd., Andover, UK, 686 pp. This catalog includes all of the Pseudococcidae and Putoidae described between 1758 and June 1993 and encompasses 288 genera and 1947 species or subspecies. The catalogue is basically set up the same as the one described above with a few minor differences such as references to checklists of mealybugs around the world, and interests and emphases of deceased coccidologists who described new mealybug taxa during their careers.

In my perusal of these books I have found a few minor errors, but these are small compared to the wonderful contribution that these publications make. It is unfortunate that the data in the databases used to formulate the books are not currently available. They could be used to discover such things as all of the species that occur on *Eriogonum* or all species known to occur in Ethiopia.

In conclusion, I strongly recommend that anyone studying scale insects buy a copy of these publications: I think you will find that they will be heavily used.

ISSIS -- VII

The meeting in Israel was an enormous success due primarily to the efforts of Yair Ben-Dov and the local organizing committee. Special acknowledgement is given to Yair, Zvi Mendel and Fabienne Asael who worked especially hard. There were four days of scientific meetings, that were divided into the following areas: Systematics and Morphology; Zoogeography and Faunistics; Biology, Monitoring and Environmental Impact; Phenology and Population Dynamics of Coccoid Pests and their Natural Enemies; Biological and Chemical Control; and Natural Enemies: Biology and Host Interaction. There also were two field trips, a banquet dinner, and several social hours. A special session was held in honor of Douglas J. Williams for his accomplishments in scale insect systematics on the occasion of his 70th birthday. At the final business meeting, the group accepted the proposal submitted by Chris Hodgson to hold ISSIS-VIII at Wye College, in southern England. We look forward to hearing more from Chris as 1998 approaches.

NEWS FROM BELTSVILLE

Over the year we have finished the paper with Doug Williams on *Micrococcus* and hope that it will be published in Italy as a companion to a paper by Marrotta and Tranfaglia on *Micrococcus*. It is fairly evident that many more species of this genus exist in the Mediterranean area, probably on some of the larger islands and in North Africa. Evelyn Danzig was able to visit this fall and we have initiated a joint project on *Trabutina*. It is an interesting group that is of special interest to the United States as a biological control agent of *Tamarix*. We would be interested in seeing any material that you think might be different. We are especially interested in Chinese material. We have nearly completed the data base of the species that occur in the collection here at Beltsville. Debra Creel has spent a great deal of effort getting it into shape. We also have started a database on the eriococcids of the world, which we hope will be a companion to the catalogs produced by Yair Ben-Dov. It is a slow process, and makes me even more impressed with the efforts of Yair.

NEWS FROM VIRGINIA POLYTECHNIC INSTITUTE

We still hope to fill the systematics position vacated by Michael Kosztarab in 1992, but because of financial problems the prospects are worse each year. The manuscript on the Scale Insects of Northeastern North America (NENA) is almost finalized. A number of new mealybugs are currently being described and illustrated for inclusion. The legless mealybug paper with Harlan Hendricks is being held back from publication because of lack of funds. Other avenues for printing are being pursued. Visitors to the laboratory were Jim Howell, Gema Perz, Evelyn Danzig, and Dug and Judy Miller. This year Michael Kosztarab gave a series of lectures at the Pannon Agricultural University, Keszthely, Hungary. He also gave a presentation at the Annual Meeting of the Entomological Society of Hungary, Budapest. The Association of Systematics Collections selected Michael as the 1994 recipient of their Recognition Award for his 10 year effort toward development of a National Biological Survey. After two years he has stepped down from the Presidency of the Virginia Association of Natural History to devote more time to scale studies. Karen Veilleux continued to add significantly to the Procite bibliographic database (see "Recent Literature"). She is willing to provide a computerized keyword search on scale insect topics from the 1390 articles of recent literature that are included in the database. See the next page for details. Mary Rhoades continues work on NENA and participated in the Sternorrhyncha conference with a presentation on leaf stomatal patterns that appear on the covers of *Chionaspis pinnifoliae*. Those interested in obtaining copies of the 18 scale insect research bulletins that we have published should write to Michael for a price quote (about 7 cents per page plus postage).

LITERATURE SEARCH

Karen Veilleux has again added significantly to the scale bibliographic database in 1994. We all are grateful for her efforts and dedication to this process.

As indicated in the last Scale, it is possible to have her run a search for your own special needs. This can be done by contacting Karen either through E-mail (KVEILL@VTVM.I.CC.VT.EDU or by mailing a request to Karen Veilleux, Department of Entomology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0319, USA. The charge for this service will be about \$15 per hour which does not even cover costs.

To date she has entered information from 1390 publications. In 1994 the following data were entered.

SCBIBIO database:

252 main entry records

SCALE10 database:

847 species records
 32 new species records
 32 host records
 33 distribution records
 7 genera records
 6 new genera records
 11 family records
 11 subfamily records
 1 new subfamily record
 1 tribe record
 1 subtribe record
 1 new combinations
 77 biological information
 139 biological control

BENDOV database:

1086 species records
 1 family record
 35 new combination
 54 biological information
 5 biological control

Recent Literature

- Abbas, A.A. & El Nasr, S.Y.E. 1992. The Sudan: new record of green pit scale insect Asterolecanium phoenicis Rao on date palm in the Sudan. FAO Plant Protection Bulletin 40(3):115.

This scale species causes yellow streaks along the veins, followed by withering and complete degeneration of the leaves; green fruits shrink and die prematurely; also distributed in Iraq, Iran, Saudi Arabia, Israel, Egypt and Qatar.

- Agounke, D. et al. 1993. Biological control of the mango mealybug (Rastrococcus invadens) in Togo. Acta Horticulturae (341):441-451.

This species accidentally introduced into West Africa where it became a pest on mango, citrus, ficus, and about 40 other plants; Gyranusoidea tebyqi introduced for successful control project.

- Ahmadi, V.A.A. & Yazdani, A. 1993. A new species of Diloponis a predator of diaspidid scales in the south of Iran (Coleoptera, Coccinellidae). Nachrichtenblatt der Bayerischen Entomologen 42(1):30-32; ill.

This coccinellid preys on red scale (Parlatoria blanchardi) on date palm, almond, ash and willow; description and illustration of male and female genitalia; first record of this genus and species in the Palearctic region.

- Almonicar, R.S. 1992. Two new insect pests attacking Acacia mangium in the Philippines. Nitrogen Fixing Tree Research Reports 10:93.

Pseudococcus sp. on roots and an undetermined insect pest on flowers has been reported; description of damage.

- Alstad, D.N., Hotchkiss, S.C. & Corbin, K.W. 1991. Gene flow estimates implicate selection as a cause of scale insect population structure. Evolutionary Ecology 5(1):88-92.

Authors believe that selection is a better explanation for scale population structure than gene flow-drift disequilibrium; Fst values in the ACP and GPI allozyme systems were uncorrelated (they should equilibrate similarly if they are affected only by drift and gene flow); interdemec gene flow in the contact zone between scale insect demes on adjacent host trees appears to cause an outbreeding depression.

- Argov, Y. & Rossler, Y. 1993. Biological control of the Mediterranean Black Scale Saissetia oleae (Hom. Coccidae) in Israel. Entomophaga 38(1):89-100. (In English, French abstract)

Seventeen species of natural enemies introduced into Israel during the time of this project (1975-1982); this paper reviews the effectiveness of that introduction; major parasitoid responsible for reduction of black scale population is Metaphycus bartletti; biology of the introduced parasites.

- Asif, G.A. & Ali, F.A. 1988. Effect of Malathion on the total body glucose and proteins in the mango mealybug Drosicha stebbingi (Coccidae: Homoptera). (Pakistan) Punjab University Journal of Zoology 3:61-69.

Effect of starvation and malathion (50 PPM and 100 PPM) has been described on the total body proteins and glucose contents of this species; starvation studied to compare among controls and treated insects; prolongation of starvation important because both protein and glucose contents increased initially; variable effects of all treatments observed on total body proteins and glucose observed.

- Atiqui, M.U.A. & Murad, H. 1992. Assessment of loss in sucrose content of sugarcane due to sugarcane mealy bug, Saccharicoccus sacchari Ckll. (India) Journal of Insect Science 5(2):196-197.

Average losses in brix, pol percent, purity and available sugar content examined; however, absolute juice cane was not affected significantly.

- Babu, T.R. & Azam, K.M. 1989. Biological control of grape mealybug Maconellicoccus hirsutus (Green). Indian Journal of Plant Protection 17(1):123-126. [Original article not available for abstract.]

Chemical control difficult due to location of pest inside the grape bunches, bark and crevices on the vine, and due to waxy coating; predator Cryptolaemus montrouzieri used for biological control.

Baggiolini, M., Guignard, E. & Bloesch, B. 1993. Infestations of mulberry scale, Pseudaulacaspis pentagona Targ. (Homoptera, Diaspididae), observed in the region of Lake Geneva. (Foyers de cochenille du murier, Pseudaulacaspis pentagona Targ. (Homoptera, Diaspididae), observes dans la region de la Cote lemanique.) (Switzerland) Revue Suisse de Viticulture, d'Arboriculture et d'Horticulture 25(3):161-165; ill. (In French, German, English & Italian abstract)

This scale is polyphagous and especially harmful to peach; recently it has been recorded on many ornamental trees and fruit trees, on a lila plant, a Catalpa tree, and on walnut trees; description of damage; morphology; life cycle.

Bai, F. & Chen, Q. 1991. Fusarium species on some insects from China. (China) Acta Mycologica Sinica 10(2):120-128. (In English, Chinese abstract)

Taxonomic study of Fusarium on 15 insect species; distribution; potential for biocontrol; Fusarium coccidicola discussed as a parasite of scale insects, such as Unaspis yanonensis, primarily on citrus in tropical and subtropical regions.

Baker, J.R. 1993. Insects. In The physiology of flower bulbs: a comprehensive treatise on the physiology of utilization of ornamental flowering bulbous and tuberous plants. De Hertogh, A. and M. Le Nard (Ed.) Amsterdam, Netherlands: Elsevier. pp. 101- 153.

Biology and principles of control of 25 types of insects including armored scale insects, Margarodid scale insects and soft scale insects; each section covers a basic description of the problems the insects create for growers, common hosts, seriousness of infestations and recommended treatments.

Balakrishnan, M.M., Vinodkumar, P.K. & Prakasan, C.B. 1992. A note on green scale-ant association on coffee. (India) Indian Coffee 56(10):5-6; ill.

Coccus viridis is an important sucking pest of coffee; parasitoids (Coccophagus spp.) and entomopathogenic fungi (Verticillium lecanii and Empusa lecanii) keep this pest under control; excretes honeydew; influence of ants (Oecophylla smaragdina, Paratrechina longicornis, Prenolepis indica, Tahinomyrmex sp., and Tapinoma melanocephalum).

Baldanza, F., Gaudio, L. & Viggiani, G. 1991. Karyological resesarch on Archenomus orientalis Silvestri (Hymenoptera: Aphelinidae), parasitoid of Pseudaulacaspis pentagona (Targioni Tozzetti) (Homoptera: Diaspididae). (Ricerche carilogiche sull'archenomus orientalis Silvestri (Hymenoptera: Apphelinidae) parasitoide di Pseudaulacaspis pentagona (Targioni-Tozzetti) (Homoptera: Diaspididae).) Atti XVI Congresso Nazionale Italiano di Entomologia :457-461; ill. (In Italian, English abstract)

Among the 30 host species for Archenomus spp. are Quadraspidotus spp., Lepidosaphes spp. and Pseudaulacaspis pentagona.

Bates, V.I. 1993. Broadening the range of pest management tools: integrated pest management in the apple and pear industry. (Australia) Plant Protection Quarterly 8(4):141-143.

Discussion of IPM, chemical control, biological control, cultural techniques, physical control, and monitoring techniques; scale insect pests mentioned include Pseudococcus longispinus and Comstockaspis perniciosus.

Beardsley, J.W. 1993. Exotic terrestrial arthropods in the Hawaiian Islands: origins and impacts. Micronesica Suppl. 4:11- 15.

More than 98% of arthropod pests now present in the Hawaiian Islands were accidentally introduced by man, the majority since Hawaii was colonized by Europeans about 200 years ago; during the past 50 years, new exotic arthropods have become established at the rate of nearly 20% per year; many new potential pests arrive with no effective natural enemies; two scale

pests are discussed as examples: Dysmicoccus neobrevipes and Conchaspis angraeci.

Beck, B. 1989. The cassava mealybug arrives in South Africa. Plant Protection Research Institute Bulletin (17):8. [Original article not available for abstract.]

Bendicho Lopez, A., Iglesias, M., Hernandez Gutierrez, A., Gonzalez Ramos, N. & Castaneda Ruiz. 1990. The potential for natural enemies of coccids infesting coffee. (Potencialidad de algunos enemigos naturales de los coccidos que afectan al cafeto.) (Cuba) Ciencias de la Agricultura 40:50-55. (In Spanish, English abstract)

Coccophagus and Fusarium species are examined in relation to their ability to provide biological control of Coccus viridis and Saissetia coffeae, pests in three coffee-growing regions of Cuba.

Ben-Dov, Y. 1993. A systematic catalogue of the soft scale insects of the world (Homoptera: Coccoidea: Coccidae) with data on geographical distribution, host plants, biology and economic importance. Gainesville, Florida: Sandhill Crane Press. 536 pp. (Flora & Fauna Handbook, No. 9.)

Review of 1090 species and subspecies in 162 genera, organized alphabetically by genus and species; synonymy; type species or type data; common names; sources for redescrptions and illustrations; references for intraspecific variations; discussions of life cycles, number of instars; chromosome numbers, natural enemies; references to the opinions of the International Commission on Zoological Nomenclature (ICZN); subject index to literature of the Coccidae; 151-page reference list; biographical data on deceased coccidologists.

Ben-Dov, Y. 1994. A systematic catalogue of the mealybugs of the world (Insecta: Homoptera: Coccoidea: Pseudococcidae and Putoidae) with data on geographical distribution, host plants, biology and economic importance. Andover, UK: Intercept Limited. 686 pp.

This catalog includes data on 1947 species and subspecies placed in 288 genera; synonymies; distributions; host plants; biographical data on deceased coccidologists; nomenclatural history of the families; 83 page list of references.

Bhumannavar, B.S. 1990. New records of some aphids, whiteflies and scale insects associated with crops in south Andaman. (India) Journal of the Andaman Science Association 6(2):169-170.

Coccus viridis recorded for the first time; Saissetia coffeae recorded on guava, and Parasaissetia nigra recorded on ornamental Hibiscus sp. and Ixora sp. for the first time.

Blahutiak, A. 1990. Annotated list of Quadraspidiotus perniciosus Comstock entomophages. Entomol Probl 20:9-19. (In Slovak, English abstract)

List of 40 species of entomophages from five families; distribution.

Blank, R.H., Lo, P.L., Gill, G.S.C. & Olson, M.H. 1992. A residual bioassay technique to investigate scale crawler settlement on kiwifruit. In Proceedings of the Forty Fifth New Zealand Plant Protection Conference, edited by A. J. Popay. Wellington, New Zealand: August 11-13, 1992. Rotorua, New Zealand: pp. 174-179.

A bioassay technique is described for testing the effectiveness of chemical residues to prevent settlement of greedy scale (Hemiberlesia rapax) on kiwifruit leaves and fruit.

Blank, R.H., Olson, M.H., Clark, J.B. & Gill, G.S.C. 1993. Investigating two bee-safe materials for controlling latania scale on avocados during pollination. In Proceedings of the Forty Sixth New Zealand Plant Protection Conference. Christchurch, New Zealand: August 10-12, 1993. Rotorua, New Zealand: pp. 80-85.

Hemiberlesia lataniae was identified as an important pest on avocados with up to 34% of fruit infested; high proportion of immature scale (94%) on fruit in late November indicated that scale invasion coincided with

pollination; fluvalinate and buprofezin evaluated for control; no clear results.

Blank, R.H., Olson, M.H. & Lo, P.L. 1993. Mineral oil and diazinon to control armoured scale on kiwifruit. In Proceedings of the Forty Sixth New Zealand Plant Protection Conference. Christchurch, New Zealand: August 10-12, 1992. Rotorua, New Zealand: pp. 71-74.

Laboratory tests on immature and mature greedy scale (Hemiberlesia rapax) stages showed mineral oil had a lower toxicity compared to diazinon or mineral oil/diazinon mixtures; when applied as a dormant season spray to kiwifruit the mineral oil/diazinon mixtures gave 86-96% control of this scale, compared to diazinon 82% and mineral oil 73% control.

Blumberg, D., Wysoki, M. & Hadar, D. 1993. Further studies of the encapsulation of eggs of Metaphycus spp. Hym. Encyrtidae by the Pyriform scale Protopulvinaria pyriformis Hom. Coccidae. (Israel.) Entomophaga 38(1):7-13.

Seasonal variations occurred in the encapsulation of eggs; high rates of encapsulation during the summer may interfere with efficient biological control.

Boscia, D., Savino, V., Minafra, A., Namba, S., Elicio, V., Castellano, M.A., Gonsalves, D. & Martelli, G.P. 1993. Properties of a filamentous virus isolated from grapevines affected by corky bark. (Italy) Archives of Virology 130(1-2):109-120; ill.

A closterovirus with particles about 800 nm long was recently recovered by inoculation of sap from a Californian grapevine (Vitis vinifera) of cv. Semillon, affected by corky bark disease (CB); study carried out on the characterization of this seemingly new closterovirus (GVB); GVB has a very restricted herbaceous host range and was experimentally transmitted by the mealybug Pseudococcus ficus.

Brink, T. 1992. Host plants of the white powdery scale, Cibrolecanium andersoni. (South Africa) Inligtingsbulletin -- Navorsingsinstituut Vir Citrus en Subtropiese Vrugte (238):11; ill.

White powdery scale; brief field description; hosts include citrus, especially grapefruits, Passiflora edulis, Strelitzia nicolai, Ficus benjamina, Ficus sur, Schefflera sp., Persea americana, Anthocleistra grandiflora, Strychnos madagascariensis, and Coffea canephora.

Brink, T. 1992. Key factor analysis of the white powdery scale, Cibrolecanium andersoni (Newstead) on citrus. (South Africa) Inligtingsbulletin -- Navorsingsinstituut Vir Citrus en Subtropiese Vrugte (238):28-29.

Pest of citrus (including Citrus reticulata) in South Africa; secretes honeydew on which sooty mould develops on leaves; description of damage; biological control of Aonidiella aurantii resulted in increased population levels of this species; natural enemies and generational mortality were examined.

Brink, T. & Hewitt, P.H. 1993. The efficacy of different insecticides against Cibrolecanium andersoni (Hemiptera (Homoptera?): Coccidae) on citrus in South Africa. Tests of Agrochemicals and Cultivars 14:8-9. (Ann. Appl. Biol., 122 (Supl.).)

White powdery scale; soft scale pest of citrus in South Africa and Swaziland; withdrawal of organophosphorus insecticides previously used against the citrus red scale, Aonidiella aurantii, probably contributed to the pest status of C. andersoni; description of damage; eight chemical control treatments tested and evaluated.

Brink, T. & Hewitt, P.H. 1993. Parasitoids of the White Powdery Scale, Cibrolecanium andersoni (Newstead) (Hemiptera: Coccidae), a pest of citrus. (South Africa) International Journal of Pest Management 39(1):99-102.

This economically important scale occurs in South Africa and Swaziland; secretes honey on which sooty mould develops; parasitoid sampling revealed seven species, the most common being Coccophagus andersoni, Euxanthellus philippiae and an unidentified encyrtidae, Metaphycus sp.

Brutsch, M.O. & Zimmermann, H.G. 1993. The prickly pear (Opuntia ficus-indica (Cactaceae) in South Africa: utilization of the naturalized weed, and of the cultivated plants. *Economic Botany* 47(2):154-162; ill. (In English, German abstract)

In spite of successful biological control efforts, vast areas of South Africa remain infested with the spiny prickly pear weed, Opuntia ficus-indica; they provide a popular fruit and a limited source of income for certain sectors of the population; a novel method for mass-rearing the cochineal insect, Dactylopius coccus, for the commercial production of a red dye (carminic acid) has been developed.

Bull, B.C., Raupp, M.J., Hardin, M.R. & Sadof, C.S. 1993. Suitability of five horticulturally important armored scale insects as hosts for an exotic predaceous lady beetle. *Journal of Environmental Horticultural* 11(1):28-30.

Chilocorus kuwanae was imported from Korea to the US for release against Unaspis euonymi; field observations suggest that C. kuwanae feeds on a number of other armored scale insects, including Pseudaulacaspis pentagona and Melanaspis obscura; this research examines predator on five scale spp. under laboratory conditions and measures average weight, number of larvae produced and average number of days to first reproduction of adult.

Burden, D.J. & Hart, E.R. 1993. Parasitoids associated with Chionaspis pinifoliae and Chionaspis heterophyllae (Homoptera: Diaspididae) in North America. *Journal of the Kansas Entomological Society* 66(4):383-391.

These pine needle scales are host to a number of primary and secondary hymenopterous parasitoids; species components vary across North America, but trophic components are representative of a general model; this model includes three trophic levels: primary ectoparasitoids, primary endoparasitoids, and secondary ectoparasitoids of the primary endoparasitoids; reported parasitoid complexes from five sites in North America are reviewed and trophic structure is discussed.

Burts, E. 1993. Pear grape mealybug control. In *Insecticide and Acaricide tests*. Burditt, A. K., Jr. (Ed.) Lanham, Maryland: Entomological Society of America. p. 56. (Vol. 18.)

Evaluation of 10 insecticides plus a control for effectiveness against Pseudococcus maritimus on Pyrus communis; Lorsban provided best control of shoot infestations during first generation; timing of spraying important.

Burts, E. 1993. Pear insecticide evaluations. In *Insecticide and Acaricide tests*. Burditt, A. K., Jr. (Ed.) Lanham, Maryland: Entomological Society of America. p. 56-57. (Vol. 18.)

Four insecticides evaluated for effectiveness against four insects, including grape mealybug, Pseudococcus maritimus on Pyrus communis.

Burts, E. 1993. Pear laboratory screening of pesticides against grape mealybug. In *Insecticide and Acaricide tests*. Burditt, A. K., Jr. (Ed.) Lanham, Maryland: Entomological Society of America. p. 371-372. (Vol. 18.)

Evaluations of thirteen pesticides tested for effectiveness against Pseudococcus maritimus on Pyrus communis.

Calatayud, P.A., Tertuliano, M. & Le Ru, B. 1992. Influence of phenolic compounds on the relationship between the cassava mealybug and its host plants. (Congo) *Series Entomologica* 49:255-257.

[Proceedings of the 8th International Symposium Insect-Plant Relationships, Dordrecht: Kluwer Acad. Publ., S.B.J. Menken, J.H. Visser & P. Harrewijn (eds.), 1992]

Phenacoccus manihoti (Homoptera, Pseudococcidae) is a phloemophagous insect feeding on Manihot esculenta; no correlation could be found between primary nutrients (sucrose and free amino acids in sieve and intercellular fluid of cassava) and antibiotic resistance; analysis of secondary compounds in the phloem sap of cassava showed only phenolic compounds.

Camporese, P. & Pellizzari-Scaltriti, G. 1991. Pseudococcus microcirculus McKenzie (Homoptera, Coccoidea) on cultivated orchids in Italy. (Segnalazione di

Pseudococcus microcirculus McKenzie (Homoptera, Coccoidea) su orchidee coltivate in Serra.) Informatore Fitopatologico 41(11):59-61. (In Italian, English abstract)

This pest species lives on roots of orchids in greenhouses in northern Italy; also found on Anselia, Cattleya, and Oncidium; also occurs in Brazil, California and Florida; list of mealybugs known to live on orchids and sometimes intercepted by quarantine services given; inspection of imported exotic plants recommended.

Cassino, P.C.R., Lima, A.F.D. & Racca Filho, F. 1991. Orthezia praelonga Douglas, 1891 on citrus trees in Brazil (Homoptera, Ortheziidae). (Orthezia praelonga Douglas, 1891 em plantas citricas no Brasil (Homoptera, Ortheziidae).) Arquivos da Universidade Federal Rural (Rio de Janeiro) 14(1):35-57; ill. (In Portuguese, English abstract)

Literature review of O. praelonga; taxonomic study; bioecology; list of about 146 hosts from 47 plant families; list of 20 natural enemies and fungi; monitoring techniques; distribution; 6-page list of references.

Cassino, P.C.R., Perruso, J.D. & Nascimento, F.N.d. 1993. Contribution to knowledge of bioecology interactions between white flies (Homoptera, Aleyrodidae) and Orthezia praelonga Douglas, 1891 (Homoptera, Ortheziidae) in the citrus environment. (Contribuicao ao conhecimento das interacoes bioecologicas entre aleiroidideos (Homoptera; Aleyrodidae) e Orthezia praelonga Douglas, 1891 (Homoptera; Ortheziidae) no Agroecos-sistema citrico.) (Brazil) Anais da Sociedade Entomologica do Brasil 22(1):209-212. (In Portuguese, English abstract)

Two hundred and forty branches of Citrus sinensis Osbeck, each one with ten leaves, were examined, and the percentage of leaves containing the species studied were noted; results indicate that white flies and O. praelonga compete for space.

Castillo L., J.A. & Bellotti, A.C. 1990. Diagnostic characters of four mealybug species (Pseudococcidae) in Cassava crops (Manihot esculenta) and observations on some of their natural enemies. (Caracteres diagnosticos de cuatro especies de piojos harinosos (Pseudococcidae) en cultivos de yuca (Manihot esculenta) y observaciones sobre algunos de sus enemigos naturales.) (Colombia) Revista Colombiana de Entomologia 16(2):33-43; ill. (In Spanish, English abstract)

Phenacoccus manihoti, P. madeirensis, Ferrisia virgata and P. herreni compared morphologically; all cause severe damage to cassava; biology; behavior; distribution; alternative hosts; natural enemies.

Chalon, P. 1993. Ultrastructural study of the mouth parts of the soft scale Eupulvinaria hydrangeae. Third Belgian Congress of Zoology 123(Suppl. 1):8. [Abstract of a paper presented at a Conference held November 5-6, 1993, in Liege, Belgium]

Scanning electron microscopy was used for examination of morphology of the mouth parts of this species.

Chandra, A., Bhati, D.P.S. & Singh, K.M. 1991. Mechanical control of mango mealy bug (D. mangiferae Green) by tree trunk banding. Indian Journal of Entomology 53(1):76-79.

Mechanical control techniques include banding with alkathene, namhar and ESSO grease bandings; alkathene found to be most suitable barrier for ascending nymphs of Drosicha mangiferae on tree trunk.

Charles, J.G., Walker, J.T.S. & White, V. 1993. Resistance to chlorpyrifos in the mealybugs Pseudococcus affinis and P. longispinus in Hawkes Bay and Waikato pipfruit orchards. In Proceedings of the Forty Sixth New Zealand Plant Protection Conference. Christchurch, New Zealand: August 10-12, 1993. Rotorua, New Zealand: pp. 120-125.

A residual bioassay was used to measure the responses to chlorpyrifos of two populations of P. affinis from Hawkes Bay, and one of P. longispinus; resistance appeared to be restricted to P. affinis in old pear orchards in

Hawkes Bay; implications of the results for future mealybug control programs in New Zealand pipfruit orchards.

- Chiu, S. 1993. Investigations on botanical insecticides in South China -- an update. In Proceedings of the Symposium on Botanical Pesticides in Integrated Pest Management. Rajahmundry: 1990. (Indian Society of Tobacco Science, Rajahmundry, India.) Indian Society of Tobacco Science; 134-137.

Review of studies on various host plants and their pests including the pine needle armored scale (Hemiberlesia pitysophila) on chinaberry seed oil and rubber tree seed oil.

- Chiu, S., Liu, X., Huang, Z., Chen, W. & Wei, X. 1993. The chemical control of the pine armoured scale Hemiberlesia pitysophila Takagi. Acta Entomologica Sinica 36(2):177-184. (In Chinese, English abstract)

An oil emulsion, formulated from rubber tree seed oil (or chinaberry seed oil) with diesel oil at a ratio of 3:7, was found to be very effective against this scale; at a concentration of 5%, it controlled 90-100%; furthermore, it was safe to Encarsia sp. and Aphytis sp., hymenopterous parasites and important natural enemies of this scale.

- Chu, C.L. 1992. Postharvest control of San Jose scale on apples by controlled atmosphere storage. (Canada) Postharvest Biology and Technology 1(4):361-369.

Storage conditions of regular controlled atmosphere, low-oxygen, and air at 1 degree C were used to control postharvest infestation of Quadraspidiotus perniciosus on apples; periodic sampling to evaluate the mortality of this scale; differences in mortality rate caused by the various storage conditions diminished as the storage period was extended to 24 weeks or longer.

- Covassi, M., Binazzi, A. & Toccafondi, P. 1991. Studies on the entomophagous predators of Matsucoccus Cock. in Italy I. Faunistical and ecological notes on species found in pine stands of Liguria and Tuscany. Redia 74(2):575-597; ill. (In Italian, English abstract)

Life cycle of the main entomophages of Matsucoccus; inventory of predators on this genus; distributions; biological and ecological notes.

- Cravedi, P. & Mazzoni, E. 1993. Response of Pseudaulacaspis pentagona (Targioni-Tozzetti) to sexual pheromone. (Italy) Bulletin OILB/SROP 16(4):4-7.

Tests performed to assess optimal pheromone to bait traps, to find traps' action range, to find time of males' emergence and maximum capacity; positive correlation found between infestation by hibernating females and captures of males during first flight.

- Cravedi, P. & Molinari, F. 1993. Synthetic pheromones in integrated pest management in peach and plum orchards in Italy. Bulletin OILB/SROP 16(10):170-173.

Among the pests against which synthetic pheromones are being tested are Pseudaulacaspis pentagona and Comstockaspis perniciososa.

- Cudjoe, A.R., Neuenschwander, P. & Copland, M.J.W. 1993. Interference by ants in biological control of the cassava mealybug Phenacoccus manihoti (Hemiptera: Pseudococcidae) in Ghana. Bulletin of Entomological Research 83(1):15-22.

Eight species of ants, mostly in the genera Camponotus, Crematogaster and Pheidole were found attending cassava mealybug; ant densities were much higher than in the savanna and, in most zones, positively correlated to mealybug population densities; weediness of the fields did not clearly influence the presence of ants; ants found to reduce parasitism rates by Epidinocarsis lopezi to half of those mealybug colonies not attended by ants.

- Danzig, E.M. 1993. Scale Insects: Families Phoenicocidae and Diaspididae. St. Petersburg: "Nauka" Publishing House. 452 pp.; ill. (Fauna of Russia and Neighbouring Countries: Rynchota, 10, New Series, No. 144.) (In Russian)

Comprehensive review includes taxonomy, synonymy, descriptions, keys,

morphology and anatomy, geographic distributions, and hosts.

Danzig, E.M. 1994. On subalpine and alpine scale fauna (Homoptera, Coccinea) of the Swiss Alps. (Zur subalpinen und alpinen Schildlausfauna (Homoptera, Coccinea) der Schweizer Alpen.) Mitteilungen Entomol. Gesellschaft Basel 44(2):45-48; ill. (In German)

List of 14 species from five families; distributions; host plants.

De Lillo, E. & Porcelli, F. 1992/93. Pyemotes herfsi (Oud.) (Acari, Pyemotidae) natural enemy of Melanaspis inopinata (Leon.) (Coccoidea, Diaspididae) in Puglia. (Pyemotes herfsi (Oud.) (Acari, Pyemotidae) antagonista di Melanaspis inopinata (Leon.) (Coccoidea, Diaspididae) in Puglia.) Entomologica (Bari) 27:117-124; ill. (In Italian, English abstract)

This association found on Cotoneaster sp.; first record of this Pyemotidae in Italy.

De Marzo, L. 1991. Discovery of Phylloxerina spp. ovipositing under empty armours of Diaspids (Homoptera: Phylloxeridae & Diaspididae). (Reperimento di fillosserine ovideponenti sotto follicoli di Diaspini (Homoptera: Phylloxeridae & Diaspididae).) In Atti XVI Congresso Nazionale Italiano di Entomologia. Bari - Martina Franca (Ta): 23/28 September. Italy: 941. (In Italian, English abstract)

Females of Phylloxerina found ovipositing under Chionaspis salicis and Quadrastidiotus gigas, on Salix alba and Populus tremula respectively.

De Villiers, E.A. 1989. Seasonal occurrence of various stages of the heart-shaped scale on avocado. (Seisoensvoorkoms van verskillende stadia van die hartvormige dopluis op avokado's.) Yearbook - South African Avocado Growers' Association 12:58-59; ill. (In Africans, English abstract)

Occurrence of this scale is increasing, in spite of various natural enemies which have suppressed this pest in the past; this research is an attempt to determine when different life stages occur in order to use chemical control during the youngest and most sensitive stage to pesticides.

De Villiers, E.A. 1992. Effect of different spraying periods on the mango scale. (Uitwerking van bespuitingstyle op mangodopluis.) (South Africa) Ingligtingsbulletin -- Navorsingsinstituut vir Sitrus en Subtropiese Vrugte (238):24-27; ill. (In Afrikaans, English abstract)

Five different insecticides were sprayed on twelve year old mango trees at two different times; results based on degree of infestation of Aulacaspis tubercularis, mango scale.

Del Vecchio, T.A., Gehring, C.A., Cobb, N.S. & Whitham, T.G. 1993. Negative effects of scale insect herbivory on the ectomycorrhizae of juvenile pinyon pine. Ecology 74(8):2297-2302.

To examine potential interactions between ectomycorrhizae and herbivory, the authors quantified the levels of ectomycorrhizal colonization of 30-yr-old pinyon pines (Pinus edulis) that were either resistant or susceptible to the sap-feeding scale insect Matsucoccus acalyptus; resistant trees also had 28% more ectomycorrhizae than susceptible trees; after removing scales from susceptible trees, levels of ectomycorrhizal colonization of susceptible trees rebounded to a level similar to that of resistant trees.

Devasahayam, S. & Kozar, F. 1993. Additions to the insect fauna associated with tree spices. (India) Entomon 18(1-2):101-102.

Brief notes on six species of insects, including Kilifia accuminata, Aspidiotus destructor, Protopulvinaria mangiferae and Pseudaulacaspis cockerelli recorded for the first time on cinnamon, clove and nutmeg plants in the nursery in Kerala, India.

Disney, R.H.L. 1992. A further case of a scuttlefly (Dipt., Phoridae) parasitizing a scale insect (Hem.-Hom., Eriococcidae). (Great Britain) Entomologist's Monthly Magazine 128(1532-1535): 39-40.

This report extends the list of Phoridae whose larvae are known to

attack Homoptera; Kerophora brunnea females were reared from Kermes sp. on Quercus macrocarpa.

- Dong, H. 1993. A preliminary study on the occurrence of Pseudococcus comstocki (Hom.: Pseudococcidae) on Clivia miniata and its control with inundative release of Cryptolaemus montrouzieri (Col.: Coccinellidae). (China) Chinese Journal of Biological Control 9(1):12-14. (In Chinese, English abstract)

Results suggest that optimal control of the scale infestation during July-September in Beijing can be achieved by releasing C. montrouzieri during August-September supplement with one application of pesticides.

- Duodu, Y.A. & Thompson, W. 1992. Management of ant-mealybug complex in pineapple fields in Guyana. FAO Plant Protection Bulletin 40(3):82-88; ill. (In English, French & Spanish abstract)

The mealybug, Dysmicoccus brevipes is the vector of both wilt and gummosis diseases of pineapple in Guyana; it is tended and protected by ants, principally Solenopsis spp. (fire ants), which feed on its honeydew; field study assessed control of the attendant ants as a means of controlling the mealybugs and compared to direct chemical treatments and bait; pest management strategy incorporating these baits is described.

- Dutta, S.K. 1992. Response of certain sugarcane varieties to scale insect and association of plant character with infestation. (India) Cooperative Sugar 23(5):337-342.

Eight sugarcane varieties tested for resistance to Melanaspis glomerata; self detaching property and looseness of adherence of dried and semidried leaf sheaths to the stem were found to be associated with resistance.

- Epenhuijsen, C.W.V., Wright, S. & De Silva, H.N. 1992. Evaluation of organic pest control agents. In Proceedings of the Forty Fifth New Zealand Plant Protection Conference, edited by A. J. Popay. Wellington, New Zealand: August 11-13, 1992. Rotorua, New Zealand: pp. 103-110.

Several chemical compounds of natural origin and four conventional pesticides were tested on four insect genera in an orchard and a greenhouse; all except Neem were better than the untreated control but Malathion was a significantly better treatment than the rest; nine compounds were used on the longtailed mealybug, Pseudococcus longispinus.

- European and Mediterranean Plant Protection Organization. 1993. Quarantine procedure/Methode de quarantaine: Methyl bromide fumigation of woody plants to control Quadraspidiotus perniciosus/Fumigation des plantes ligneuses au bromure de methyle contre Quadraspidiotus perniciosus. Bulletin OEPP/EPPO Bulletin 23(no. 5):205. (In English & French)

San Jose scale; instructions for fumigation; plants must be fully dormant, especially Tilia spp.

- European and Mediterranean Plant Protection Organization. 1993. Quarantine procedure/Methode de quarantaine: Hydrogen cyanide fumigation of woody plants to control Quadraspidiotus perniciosus/Fumigation des plantes ligneuses a l'acide cyanhydrique contre Quadraspidiotus perniciosus. Bulletin OEPP/EPPO Bulletin 23(no. 4 (rev.)):204. (In English & French)

San Jose scale; instructions for fumigation; cautions.

- Farrell, G.S. 1991. Description of the immature stages and the adult male of an Australian mealybug Melanococcus albizziae Maskell (Coccoidea: Pseudococcidae). Mem. Mus. Vic. 51(1):49-64; ill. [Original article not available for abstract.]

- Farrell, G.S. 1991. Redescription of Cryptes baccatus Maskell (Coccoidea: Coccidae), an Australian species of soft scale. Mem. Mus. Vic. 51(1):65-82; ill. [Original article not available for abstract.]

- Fernandes, I.M. 1989. Contribution to the knowledge of Coccoidea (Homoptera) from Angola. (Contribuicao para o conhecimento de Coccoidea (Homoptera) de Angola.) Garcia de Orta, Ser. Zool. 15(1):129-134; ill. (In Portuguese, English abstract)

Three species reviewed: Ceroplastes rusci, Gascardia destructor and Hemiberlesia lataniae; synonymy; descriptions; plant hosts; distributions.

Fernandez, M. & Rodriguez, M.E. 1988. Effectiveness of five products in the chemical control of Unaspis citri (Homoptera: Diaspididae). (Efectividad de cinco productos en el control quimico contra Unaspis citri (Homoptera: Diaspididae).) (Cuba) Revista de Proteccion Vegetal 3(1):45-52. (In Spanish, English abstract) [Original article not available for abstract.]

Ferris, G.F. 1955. Some minute insects: Anoplura, Mallophaga and the scale insects. In A Century of Progress in the Natural Sciences: 1853-1953. San Francisco: California Academy of Sciences. 807 pp.

The need to develop proper methods by which minute insects can be studied is emphasized; history of systematics of scale insects reviewed; estimate is made that there are from 12,000 to 30,000 species of Coccoidea.

Gagne, R.J. & Bennett, F.D. 1993. Two new species of Lestodiplosini (Diptera: Cecidomyiidae) preying on Homoptera and Thysanoptera in southern Florida. Florida Entomologist 76(2):341-348; ill. (In English, English & Spanish abstract)

One of these new species, Lestodiplosis laticaulis, preys on Diaspis echinocacti.

Garonna, A.P. 1991. Biological aspects of Comperiella lemniscata Compere & Annecke (Hymenoptera: Encyrtidae), endophagous parasitoid of Chrysomphalus dictyospermi (Morgan) (Homoptera: Diaspididae). (Aspetti biologici di Comperiella lemniscata Compere & Annecke (Hymenoptera: Encyrtidae), parassitoide endofago di Chrysomphalus dictyospermi (Morgan) (Homoptera: Diaspididae).) Atti XVI Congresso Nazionale Italiano di Entomologia 16:363-366. (In Italian, English abstract)

Life cycle; reproduction; field notes.

Gauthier, N.L. 1993. Scale control on highbush blueberry. The Grower: Vegetable and Small Fruit Newsletter 93(2):4-5.

The major cause of scale infestation is Diaspidiotus ancyclus, Putnam scale; description of damage; field description; life cycle; control measures; other scale species attacking blueberry are Azalea bark, cottony maple, European fruit Lecanium, Japanese wax, oak Eriococcus, parlatorialike, and red bay.

Ghule, B.D. & Dhumal, V.S. 1992. Chemical control of mealybugs on guava. (India) Journal of Maharashtra Agricultural Universities 17(2):321-322.

Drosicha mangiferae causes considerable damage to Psidium guajava; eleven chemical treatments tested.

Ghule, B.D. & Dhumal, V.S. 1992. Chemical control of scale insects on pomegranate. (India) Journal of Maharashtra Agricultural Universities 17(2):322-323.

Parasaissetia nigra causes considerable damage to Prunica granatum; nine chemical treatments tested.

Goux, L. 1992. Description of three new species of Eriococcus (Homoptera, Coccoidea). (Description de trois cochenilles nouvelles appartenant au genre Eriococcus (Homoptera, Coccoidea) (52eme note sur les coccides de France).) Bulletin de la Societe Linnea de Provence 43:41-46; ill. (In French, English, Esperanto abstract)

Eriococcus puymorensis, E. guesinus and E. gassinus identified; descriptions; hosts.

Grafton-Cardwell, E.E. & Ouyang, Y. 1993. Toxicity of four insecticides to various populations of the predacious mite, Euseius tularensis Congdon (Acarina: Phytoseiidae) from San Joaquin Valley California citrus. Journal of Agricultural Entomology 10(1):21-29.

The resistant population of this mite should be useful for mass-rearing and release in orchard situations in the process of transition from a purely broad spectrum approach to an approach utilizing selective pesticides; armored scale insects such as Aonidiella aurantii and A. citrina are among those that require pesticide applications in this part of California;

insecticides used for scale control seemed to be less toxic to this mite than others.

Gravena, S., Paiva, P.S.B. & Yamamoto, H. 1993. Impact of methidathion on citrus entomofauna: I. Perspective of ecological selectivity. (Brazil) Bulletin OILB/SROB 16(7):16-25; ill.

Impact of chemicals on natural enemies of Unaspis citri, Parlatoria cinerea and Selenaspidus articulatus investigated; bromopropylate sprayed as full cover on the citrus foliage and methidathion applied on the trunk and primary branches were not harmful to the citrus beneficial insects and mites; methidathion in alternated rows reduced significantly the coccinelids Pentila egea and Coccidophylus citricola and the predatory mites Euseius citrifolius and Iphiseiodes zuluagai but did not affect Neuroptera (Chrysopids).

Grout, T.G., Richards, G.I. & Stephen, P.R. 1992. The possibility of reducing spray volumes used for the control of red scale Aonidiella aurantii (Mask.). (South Africa) Citrus Journal 2(3): 34-36.

Preliminary field trials conducted on citrus in winter and summer using mistblowers.

Gullan, P.J. & Buckley, R.C. 1990. Coccids in ants nests inside live plants in Australia and Papua New Guinea (Homoptera: Coccoidea: Coccidae). In Proceedings of the Sixth International Symposium of Scale Insect Studies, edited by J. Koteja. Cracow: Agricultural University Press; 1-162.

Cryptostigma live in hollow chambers in live plant stems and branches, in association with ants; recorded on 11 plant families in the nests of ants belonging to five genera: Crematogaster, Iridomyrmex, Podomyrma, Camponotus, and Tetraponera; description of chambers and behavior.

Gumus, M. & Uygun, N. 1992. Determining a better sampling scheme of the Aonidiella aurantii (Maskell) (Homoptera: Diaspididae) which is an important pest of citrus. (Turkey) Turkiye Entomoloji Dergisi 16(4):209-216; ill. (In Turkish, English abstract) [Original article not available for abstract.]

Gutierrez, A.P., Neuenschwander, P. & Van Alphen, J.J.M. 1993. Factors affecting biological control of Cassava mealybug by exotic parasitoids: a ratio-dependent supply-demand driven model. Journal of Applied Ecology 30(4):706-721.

A unified ratio-dependent supply-demand driven tritrophic model of the cassava (Manihot esculenta) system was compared to field data, and then used to explore the basis for the successful control of cassava mealybug, Phenacoccus manihoti in Africa by the exotic parasitoid Epidinocarsis lopezi; causes for failure of the related parasitoid E. diversicornis were also examined.

Habibian, A. 1991. Some studies on Prospaltella berlesei in biological control on Pseudaulacaspis pentagona in Guilan Province. (Iran) Applied Entomology and Phytopathology 58(1-2): 41-42.

Biology of this parasite of mulberry scale and effect of low temperatures on development.

Hanks, L.M. & Denno, R.F. 1993. Natural enemies and plant water relations influence the distribution of an armored scale insect. Ecology 74(4):1081-1091.

In urban settings, the armored scale insect, Pseudaulacaspis pentagona infests mulberry trees in disturbed landscape habitats (roadsides, parking lots) but not trees in forested habitats (woodlots). Populations of P. pentagona are contagiously distributed among mulberry trees in landscape habitats; the interaction of two factors investigated: natural enemies and plant water potential, and how they affect the spatial distribution and abundance on this scale species.

Hara, A.H., Hata, T., Hu, B.K.S. & Tenbrink, V.L. 1993. Hot-water immersion as a potential quarantine treatment against Pseudaulacaspis cockerelli (Homoptera: Diaspididae). Journal of Economic Entomology 86(4):1167-1170.

Lethal immersion in water at 47, 48, and 49 degrees C from 0 to 10 min intervals was determined for the crawler, nymph, and female adult stages of Pseudaulacaspis cockerelli (Cooley) on bird of paradise, Strelitzia reginae Aiton, leaves; crawlers appeared more tolerant to hot-water immersion than female adults; increased exposure time resulted in a linear increase in mortality for all temperatures; exposure to 49 degrees C water for 5, 5, and 6 min resulted in 100% mortality of adults, nymphs, and crawlers, respectively; our proposed quarantine hot-water treatment can be adjusted to any specific risk level, including zero tolerance.

Hare, J.D. & Luck, R.F. 1991. Indirect effects of citrus cultivars on life history parameters of a parasitic wasp. *Ecology* 72(5):1576-1585.

Sex ratio, initial egg complement, and size of adult Aphytis melinus, an ectoparasitoid of California red scale, Aonidiella aurantii; host scales were reared on leaves of four citrus cultivars previously shown to differ in suitability for scale growth and survival; wasps from scales reared on leaves of lemon (Citrus limon) produced nearly twice the proportion of female progeny as did wasps from scales reared on leaves of grapefruit (Citrus paradisi), orange (Citrus sinensis), or mandarin (Citrus unshiu); female wasps from lemon-reared scales had highest initial egg complement, followed by wasps reared from grapefruit, mandarin, and orange; scales reached largest size when reared in cool autumn temperatures and were more than twice as suitable for the production of fecund, female A. melinus as scales reared in early summer or midsummer.

Hare, J.D., Millar, J.G. & Luck, R.F. 1993. A caffeic acid ester mediates host recognition by a parasitic wasp. *Naturwissenschaften* 80(2):92-94.

This research demonstrates that a previously unknown ester of caffeic acid and tyrosine, *O*-caffeoyltyrosine, is a major component of the kairomone from Aonidiella aurantii, that the predator, Aphytis melinus, responds quantitatively to variation in *O*-caffeoyltyrosine concentration, and that the dose eliciting peak activity by the wasp corresponds with the amount observed in scale covers when scales are most suitable for parasitization by A. melinus.

Harusawa, S., Osaki, H., Takemura, S., Yoneda, R. & Kurihara, T. 1992. (3,3)Sigmatropic ring expansion of cyclic thionocarbonates. 5. Stereoselective synthesis of the yellow scale pheromone. (Japan) *Tetrahedron Letters* 33(18):2543-2546.

The yellow scale, Aonidiella citrina, is a severe pest of ornamental plants and citrus fruit in California and Japan.

Hattingh, V. 1993. Mealybugs and cottony cushion scale on citrus in Southern Africa. *Citrus Journal* 3(2):20-22; ill.

Taxonomic information about mealybugs; common names of Icerya purchasi; economic importance; natural enemies and biological control; field descriptions; key provided.

Hattingh, V. & Samways, M.J. 1993. Evaluation of artificial diets and two species of natural prey as laboratory food for Chilocorus spp. (South Africa) *Entomologia Experimentalis et Applicata* 69(1):13-20.

Promising diets were screened and the most successful modified with additives used in artificial diets for other entomophagous insects; two suitable diets were obtained, one for adults and one of larvae of Chilocorus nigritus; they were still inferior to natural prey and not adequate as the sole food source for rearing consecutive generations, but useful as substitute food in the insectary during shortages of natural prey; oleander scale, Aspidiotus nerii and Asterolecanium miliaris were evaluated and considered suitable as natural prey for C. nigritus, C. bipustulatus and C. infernalis.

Heidari, M. & Copland, M.J.W. 1993. Honeydew a food resource or arrestant for the mealybug predator Cryptolaemus montrouzieri. (Great Britain) *Entomophaga* 38(1):63-68. (In English, French abstract)

An investigation of honeydew as a source of food or an arrestant stimulus for adults and fourth instar larvae of Cryptolaemus montrouzieri; adult predators fed on honeydew but produced few viable eggs; in the presence of honeydew the adult and larvae spent a significantly longer time searching and made more intensive searches on leaf surfaces than on clean parts of the leaf; its prey is Pseudococcus affinis.

- Hill, M.G., Allan, D.J., Henderson, R.C. & Charles, J.G. 1993. Introduction of armoured scale predators and establishment of the predatory mite Hemisarcoptes coccophagus (Acari: Hemisarcoptidae) on Latania scale, Hemiberlesia lataniae (Homoptera: Diaspididae) in kiwifruit shelter trees in New Zealand. *Bulletin of Entomological Research* 83(3):369-376.

Chilocorus bipustulatus, C. infernalis, C. cacti, Hemisarcoptes coccophagus and H. cooremani were imported and released for biological control of Hemiberlesia rapax, H. lataniae and Aspidiotus nerii on Populus nigra; biology and ecology of these natural enemies; establishment records.

- Hodgson, C.J. 1993. The immature instars and adult male of Etiennia (Homoptera: Coccidae) with a discussion of its affinities. *Journal of African Zoology* 107(3):193-215; ill. (In English, French abstract)

The immature stages and adult males of Coccoidea are considered to provide a better picture of their phylogeny than the degenerate adult females; descriptions of 1st instar crawler, 2nd and 3rd instar females and 2nd instar, prepupa, pupa and adult males of Etiennia petasus and comparisons to similar stages of E. gouligouli, E. multituberculum, E. montrichardiae, E. ferox and E. sinetuberculum; range of variation for each instar within the genus is small; key provided for instar identification; Etiennia is determined to be close to the 'Coccus' group, but is more primitive.

- Hodgson, C.J. 1994. The scale insect family coccidae: an identification manual to genera. Wallingford, Oxon, UK: CAB International. 639 pp.; ill.

This book redescribes and illustrates the adult females of the type species of about 160 soft-scale genera -- about 15 percent of all known species in this family; extensive review of anatomical terminology and taxonomic significance of the structures; keys to subfamilies and genera; hosts of specimens; distributions; 17-page reference list.

- Hofstee, S.K., Pijls, J.W.A.M. & Van Alphen, J.J.M. 1993. The attractiveness of Cassava infested with different Phenacoccus- (Cassava mealybug) species to two Epidinocarsis-species. *Mededelingen van de Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent* 58(2B):543-549.

These two species have been introduced from South America to control the cassava mealybug (Phenacoccus manihoti) in Africa; E. lopezi is considered to be a specialist on this mealybug whereas E. diversicornis may be a more generalist parasitoid; this study examines the attractiveness of cassava infested with either P. manihoti or P. herreni, for both E. lopezi and E. diversicornis; results indicate that E. lopezi only responds to P. herreni and that E. diversicornis does not respond to either.

- Howell, J.O. 1992. Descriptions of the first instars of the North American species of Rugaspidiotinus (Homoptera: Coccoidea: Diaspididae). *Journal of Entomological Science* 27(4):301-310; ill.

Three North American species described and illustrated: Rugaspidiotinus circumdatus, including two species transferred from Rugaspidiotus, Rugaspidiotinus sculpturatus and R. nebulosus; taxonomic notes; hosts.

- Hu, X. & Li, S. 1993. Three new species of the genus Kermes (Homoptera: Coccoidea: Kermesidae) from China. In *Contributions to Entomological Research*. China: Agricultural Science & Tech. Publishing House. pp. 18-27; ill. (In Chinese, English abstract)

Kermes multiporus, K. peronatus and K. trichrous described.

- Hu, X. & Li, S. 1994. Revision of the Family Kermesidae (Homoptera: Coccoidea) in China (I). (China) *Journal of Shandong Agricultural University* 25(1):39-45. (In Chinese, English abstract)

Discussion on the two subfamilies of Kermesidae (Kermesinae Signoret and Reynvaaniinae Hu & Lu) with a key to the eight world genera.

Husain, T. 1991. New records of chalcidoid parasites (Hymenoptera) on pests of pepper and sorghum in India. *Polskie Pismo Entomologiczne [Bulletin Entomologique]* 61:p. 185.

Nine chalcidoid parasites have been reared from Marsipococcus marsupiale and two aphids.

Hywel-Jones, N.L. 1993. Torrubiella luteorostrata: a pathogen of scale insects and its association with Paecilomyces cinnamomeus with a note on Torrubiella tenuis. *Mycological Research* 97(9): 1126-1130; ill.

This host association is reported for the first time from Thailand; they are commonly found during the rainy season on scale insects.

Itioka, T., Inoue, T. & Ishida, N. 1992. A ten-year study of population dynamics of citrus pests in the pesticide-reduced orchard. *Researches on Population Ecology* 34(2):227-247; ill. (In English, Japanese abstract)

Survey taken of population of Unaspis yanonensis, one of the most harmful insect pests in citrus orchards in Japan, and six other species, after low level pesticide usage; this type management system is confirmed to be effective; low total tree mortality after ten years.

Izraylevich, S. & Gerson, U. 1993. Mite parasitization on armored scale insects: host suitability. (Israel) *Experimental and Applied Acarology* 17(12):861-875.

Study of armored scale insects (Homoptera: Diaspididae): Parlatoria pergandii, P. cinerea, Aspidiotus nerii and Hemiberlesia lataniae; host suitability for the parasitic mite Hemisarcoptes coccophagus; evaluated by mite survival, mean intensity and fecundity; their stages; host plants; implication for biological control.

Izraylevich, S. & Gerson, U. 1993. Population dynamics of Hemisarcoptes coccophagus Meyer (Astigmata: Hemisarcoptidae) attacking three species of armored scale insects (Homoptera: Diaspididae). (Israel) *Experimental and Applied Acarology* 17(12): 877-888.

This parasitic mite feeds on Parlatoria pergandii, P. cinerea, Hemiberlesia lataniae and Aspidiotus nerii; overall dynamics of mite populations were similar on the different scale species, although the level of attack on each sampled host was different; rates of young mite stages were highly variable on all three hosts throughout the sampling period while adult rates were stable, constituting around 20% of all mites; no oviposition by mites occurred in mid-winter on any scale species, on any plants or parts, at all sampling sites; highest mite prevalence (parasitization rate) occurred on latania scale; H. coccophagus prefers ovipositing scale females.

Jalaluddin, S.M. & Mohanasundaram, M. 1993. Biological studies of the coconut mealybug Palmicutor sp. (India) *Indian Coconut Journal* 23(11):9-11.

Family: Pseudococcidae; life cycle; fecundity; longevity; sex ratio.

Jervis, M. & Kidd, N. 1993. Integrated pest management in European olives -- new developments. (Great Britain) *Antenna* 17(3):108-114; ill.

Nutritional, economic, political and historical importance of Olea europea; damage caused by insect pests, including Saissetia oleae; problems with insecticide control; history of attempts at control by introduction of exotic parasitoids and predators; review of role of non-crop vegetation in the conservation and augmentation of natural enemies; use of semiochemicals in mating disruption; effect of fruit attack by insects and consequent pesticide use, upon quality of olive oil.

Kadiata, B.D., Ntonifor, N.N. & Mulongoy, K. 1992. A severe mealybug infestation on some tree legumes. (Nigeria) *Nitrogen Fixing Tree Research Reports* 10:70-72.

Observations of mealybug, Ferrisia virgata; brief description; association with Paraserianthes falcataria noted; hosts include these potted

tree species in greenhouse: Albizia lebbeck, Gliricidia sepium, Leucaena leucocephala and Cassia siamea; description of damage and degree of infestation; can transmit swollen shoot disease in cocoa.

Kairo, M.T.K. & Murphy, S.T. 1992. An analysis of insecticide use in Kenya coffee IPM and outbreaks of Icerya pattersoni. In Proceedings -- Brighton Crop Protection Conference Pests and Diseases. Brighton, UK: November 23-26, 1992. Farnham, UK: British Crop Protection Council; p. 1027-1032.

Pest control measures with particular reference to insecticide use patterns on large-scale coffee estates in Kenya were surveyed through formal questionnaires and informal farm visits; between 1970 and 1985, farmers relied less and less on insecticides for pest control as IPM principles became more widely adopted.

Kapatos, E.T. & Stratopoulou, E.T. 1990. Population dynamics of Saissetia oleae. II. Life-tables and key-factor analysis. (Greece) Entomologia Hellenica (8):59-64. (In English, Greek abstract) [Original article not available for abstract.]

Life-tables were constructed for this species on olive in Corfu; key factor analysis indicated that mortality of young stages was caused mainly by high temperatures, and in spring caused mainly by predators.

Karaca, I. & Uygun, N. 26-29 Eylül 1990. Natural enemies of Aonidiella aurantii (Maskell) (Homoptera, Diaspididae) in East Mediterranean citrus areas, and their population development on different citrus varieties. (Dogu Akdeniz Bolgesi turuncgillerinde zararlı Aonidiella aurantii (Maskell) (Homoptera, Diaspididae) 'nin dogal dusmanlari ve bunlari degisik turuncgil tur ve cesitlerinde populasyon gelismesinin saptanmasi.) In Proceedings of the Second Turkish National Congress of Entomology. Izmir, Turkey: 97-108. (In Turkish, English abstract)

Only two hymenopteran parasitoids, Aphytis melinus and Comperiella bifasciata were recorded parasitizing this scale species; the highest parasitization rate occurred on oranges, followed by mandarin, lemon and grapefruit; main predators were found to be Lindorus lophantae, Chilocorus bipustulatus and Cybocephalus fodori minor.

Karam, H.H. 1991. Immature stages of Aclerda takahashii Kuwana (Homoptera: Coccoidea: Aclerdidae). (Egypt) Alexandria Journal of Agricultural Research 36(3):341-353; ill. (In English, Arabic abstract)

This species recorded on Panicum turgidum and sugarcane; reproduces parthenogenetically and ovoviviparously; description and illustration of three nymphal stages.

Karam, H.H. & Abu-Elkhair, S.S. 1992. First record of Pulvinaria elongata Newstead (Homoptera: Coccoidea, Coccidae) in Egypt. Alexandria Journal of Agricultural Research 37(1):587-594; ill. (In English, Arabic abstract)

This species attacks the leaves of sugarcane; discussion of taxonomic status; description.

Katsoyannos, P. 1992. Olive pests and their control in the Near East. Rome: Food and Agriculture Organization of the United Nations. 178 pp.; ill. (FAO Plant Production and Protection Paper, No. 115.)

Discussion of pest problems affecting olives in the Near East region; describes current control methods and various possibilities for IPM; among scale insects discussed are Saissetia oleae, Philippia follicularis, Lichtensia viburni, Pollinia pollini, Aspidiotus nerii, Parlatoria oleae and Lepidosaphes ulmi; directories of national institutes, international organizations and distribution of scientists involved in olive pest control; 25-page list of references.

Katsoyannos, P. 1993. IPM for citrus insect pests in northern Mediterranean countries. FAO Plant Protection Bulletin 41(3-4): 177-198. (In English, French & Spanish abstract)

Review of common control methods in this region, especially biological control; sampling methodologies and thresholds for pesticide treatment of

the main insect pests have been worked out and pesticide selectivity has been studied; cultural practices contributing to insect pest control have been identified and biotechnical control methods, including the use of behavior-modifying chemicals and application of the sterile insect technique, are being developed; mealybugs and scale pests include Planococcus citri, Aonidiella aurantii, Lepidosaphes beckii and Saissetia oleae; parasitoids and predators associated with classical and natural biological control listed and region where they have been introduced or monitored.

- Kim, K.C. & Oh, K.I. 1992. Bionomics, host range & analysis of damage aspects on the black pine bast scale Matsucoccus thunbergianae (Homoptera: Coccoidea), in the coastal area of Southwest Korea. (Korea) Korean Journal of Applied Entomology 31(4):386-395. (In Korean, English abstract)

This species causes severe damage to black pines; biology; host plants include Pinus thunbergii, P. strobus, P. taeda, P. banksiana, P. massoniana, P. taiwannesis and P. densiflora; percentage of damage to pines examined by age of trees; the higher the density of trees beyond 20 trees per 100m squared, the higher the damage rate was.

- Konar, A. & Ghosh, M.R. 1990. Important pests of orange Citrus reticulata in the Darjeeling district, West Bengal. (India) Environment & Ecology 8(1A):11-18.

Of about 70 insects infesting orange in this district, only a few caused considerable damage; among the scale insects that were frequently encountered were Saissetia coffeae, S. hemispherica, Ceroplastes rubens, Mytilococcus beckii, M. gloverii, Coccus hesperidum, and Planococcus citri.

- Kosztarab, M. & Watson, E. 1994. Phenological, behavioral, and biological observations on a giant scale, Neosteingelia texana Morrison, in Blacksburg, Virginia (Homoptera: Coccinea: Margarodidae). Banisteria (4):24-25; ill.

This secretive scale spends most of its life under bark flakes of shagbark hickory (Carya ovata) and pecan (C. illinoensis); potential pest of pecan plantations; distribution; measurements on climatic factors influencing its appearance for mating.

- Koteja, J. 1989. Baisococcus victoriae gen. et sp. n. -- a lower cretaceous Coccid (Homoptera, Coccinea). Acta Zoolologica Cracov. 32(6):93-105; ill. (In English, Polish abstract) [Original article not available for abstract.]

- Koteja, J. & Zak-Ogaza, B. 1989. Scale insects (Homoptera: Coccinea) of the Swietokrzyskie Mountains (Gory Swietokrzyskie). Fragmenta Faunistica 32(12):243-258. (In Polish, English & Russian abstract) [Original article not available for abstract.]

- Kozar, F. 1991. Assemblage of scale insects (Homoptera: Coccoidea) in the Pilis Biosphere Reservation. (Hungary) Allattan Kozlemenyek 77:79-82. (In Hungarian, English abstract)

83 scale insect species found in these mountains; 13 new for the Hungarian fauna; indicator species of the mountains are suggested.

- Kozar, F. 1992. Resource partitioning of host plants by insects on a geographic scale. (Hungary) Series Entomologica 49:46-48.

Discussion of resource partitioning on plants differing in evolutionary age, species richness, distribution, chemistry, etc.; Diaspididae family is used as a global and regional example; evolutionary patterns (such as historical age, genetic capabilities) and biogeographic processes (such as historical events, plate tectonics, isolation, glaciation and climatic zonation) implicated.

- Kyparissoudas, D.S. 1990. Determination of spray dates of the control of the first generation of Quadraspidiotus perniciosus in Northern Greece. (Greece) Entomologia Hellenica 8:5-9. (In English, Greek abstract) [Original article not available for abstract.]

Adult males monitored with pheromone traps, and crawlers with sticky traps, in apple orchards in northern Greece; chemical control

recommendations.

Lattin, J.D. & Stanton, N.L. 1993. Taxonomic and biological notes on North American species of Elatophilus reuter (Hemiptera: Heteroptera; Anthocoridae). Journal of the New York Entomological Society 101(1):88-94.

Of the 18 species of Elatophilus, five are known predators of species of Matsucoccus, pests of pine.

Laurence, G.A. 1991. The scale insects of Trinidad and Tobago. Journal of the Agricultural Society (Trinidad) 1:19-23, 26-29, 32-36.

List of 75 insects recorded in Trinidad and/or Tobago; host plants; distributions.

Lipshchitz, N. & Mendel, Z. 1989. Interactions between hosts and non-hosts of Pinus spp. and Matsucoccus josephi: anatomical responses of stem to infestation. (Israel) New Phytol. 113:135-142; ill.

Artificial infestation revealed that this scale (Homoptera: Margarodidae) completes its development on three pine species (Pinus brutia, P. eldarica and P. halepensis, whereas only a small number of the scale larvae infesting P. canariensis and P. pinea reached the second instar and none developed to the adult stage; crawlers died while trying to feed on P. radiata and P. pinaster; histological changes of hosts during infestation discussed.

Liu, T. & Howell, J.O. 1994. A new species of Haliaspis from Texas, USA (Homoptera: Coccoidea: Diaspididae). Journal of Entomological Science 29(1):134-140; ill.

Description and illustration of adult female and first instar; recorded on Spartina sp. leaf on South Padre Island; key to 10 species of genus.

Lo, P. & Blank, R.H. 1992. Effect of pesticides on predation of soft wax scale by the steel-blue ladybird. In Proceedings of the Forty Fifth New Zealand Plant Protection Conference, edited by A. J. Popay. Wellington, New Zealand: August 11-13, 1992. Rotorua, New Zealand: New Zealand Plant Protection Society; pp. 99-102.

Nine fungicides, five insecticides and spreader-sticker were bioassayed on citrus leaves, to determine their effect on predation of (Ceroplastes destructor) by Orchus chalybeus.

Lo, P.L. & Blank, R.H. 1992. Fungicides and insecticides disrupt predation by ladybirds on citrus. (New Zealand) The Orchardist 65(11):14-15; ill.

Discussion of attempts to control immature wax scale (Ceroplastes destructor), pest of citrus, by introduction of steel-blue ladybird into New Zealand from Australia (Orchus chalybeus); effects of fungicides and insecticides also considered.

Lockhart, B.E.L., Autrey, L.J.C. & Comstock, J.C. 1992. Partial purification and serology of sugarcane mild mosaic virus a mealybug-transmitted closterovirus. Phytopathology 82(6): 691-695; ill.

A previously undescribed closterovirus with particles measuring 1,500 - 1,600 nm X 12 nm was found in 11 cultivars of sugarcane (Saccharum sp.) from Florida, Mauritius, and Malawi; not transmitted by Melanaphis sacchari but was transmitted to both sugarcane and rice by the pink sugarcane mealybug, Saccharicoccus sacchari; description of damage.

Lorenzo, C.D., Prendes, C., Cabrera, R., Hodgson, F.M. & Coello, A.M. 1991. Contribution to the knowledge of the larvae of scale insects I. Diaspis (Adiscaspis) barrancorum Lindinger. (Canary Islands) Bocagiana (Funchal) (148):1-6; ill. (In English, Spanish abstract)

Family: Diaspididae; endemic to the Canary Islands; descriptions of eggs and larvae.

Malumphy, C. 1993. First interceptions of Paracoccus burnerae (Brain) (Homoptera: Pseudococcidae) in Britain. Entomologist's Gazette 44(4):303-305.

This species discovered on imported oranges (Citrus sinensis, naval and Valencia oranges, and C. paradisi; from South Africa; brief field description; polyphagous; occurs on many crop and ornamental plants

belonging to 16 plant families; minor pest of citrus and purple granadilla in South Africa; also distributed in Angola, Ascension Islands, Kenya, India, Mozambique, Saint Helena, Zaire, and Zimbabwe; often mistaken for Planococcus citri; always attended by ants in South Africa; parasites include Alamella kerrichi, Gyranusoidea munda, Rhopus urbanus, Timberlania gilva and T. signata; biology; threats to this specie's establishment in Britain include potato, hibiscus, oleander and cucumber (under laboratory conditions).

Mani, M. & Krishnamoorthy, A. 1992. Influence of constant temperatures on the developmental rate, progeny production, sex ratio and adult longevity of the grape mealybug parasitoid, Anagyrus dactylopii (How.) (Hymenoptera: Encyrtidae). (India) Insect Science and its Application 13(5):697-703.

20 to 35 degrees C found to be optimum for development; sex ratio altered considerably by different temperatures; adult longevity of both sexes declined with increasing temperature.

Mani, M., Krishnamoorthy, A. & Rao, M.S. 1993. Toxicity of different pesticides to the exotic parasitoid, Leptomastix dactylopii How. Indian Journal of Plant Protection 21(1):98-99.

L. dactylopii has been successful in controlling the citrus mealybug, Planococcus citri, a serious pest of fruit crops in India; this paper tests the effects of 18 pesticides on the parasitoid.

Marotta, S. & Priore, R. 1994. Morphological notes on Marchalina hellenica (Gennadius) (Homoptera Coccoidea Margarodidae). (Note morfologiche su Marchalina hellenica (Gennadius) (Homoptera Coccoidea Margarodidae).) (Italy) Bollettino del Laboratorio di Entomologia Agr Filippo Silvestri 49(1992):195-202; ill. (In Italian, English abstract)

This giant scale species is harmful to pines (Pinus pinea) in Ischia island (Naples province); fundamental morphological characteristics of adult female and immature stages, and key for identification given.

Marotta, S. & Tranfaglia, A. 1994. Coccid fauna of the Appenninic areas of Abruzzo (Homoptera Coccoidea). A contribution. (La coccidofauna dell'Appennino abruzzese (Homoptera Coccoidea). Il contributo.) (Italy) Bollettino del Laboratorio di Entomologia Agr Filippo Silvestri 49(1992):99-116; ill. (In Italian, English abstract)

New data given for 7 mealybug species and one new species (Trionymus scaramellai; 2 species new to Italy (Coccidohystrix splendens and Heliococcus cydoniae).

Marotta, S. & Tranfaglia, A. 1994. Research on Delottococcus euphorbiae (Ezzat & McConnell) (Homoptera Coccoidea Pseudococcidae). I. Morphological and systematic aspects. (Ricerche su Delottococcus euphorbiae (Ezzat & McConnell) (Homoptera Coccoidea Pseudococcidae). I. Aspetti morfologici e sistematici.) (Italy) Bollettino del Laboratorio di Entomologia Agr Filippo Silvestri 49(1992):85-98; ill. (In Italian, English abstract)

This little known mealybug is indigenous of South Africa; reported for the first time in Italy on Pelargonium spp. and Stapelia sp. in 1981; observations on adult female and immature stages.

Masoodi, M.A., Trali, A.R., Bhat, A.M., Tikku, R.K. & Nehru, R.K. 1989. Establishment of Aphytis sp. Proclia group on San Jose scale in Kashmir. Indian Journal of Plant Protection 17(1):71-73. [Original article not available for abstract.]

Mazzeo, G., Longo, S. & Russo, A. 1994. New data on scale insects fauna of Southern Italy (Homoptera). (Nuove acquisizioni sulla coccidofauna dell'Italia meridionale.) (Italy) Mem. Soc. ent. ital., Genova 72(1993):201-209; ill. (In Italian, English abstract)

Review of 17 species from 5 families; synonymy; host plants; distributions within Italy.

McClure, M.S. 1991. Adelgid and scale insect guilds on hemlock and pine. General Technical Report, (U.S.D.A., Forest Service) (NE-153):256-270; ill.

Five piercing and sucking insects accidentally introduced from Asia and one native species reviewed including two armored scales, Fiorinia externa and Nuculaspis tsugae attacking Tsuga canadensis, and one margarodid, Matsucoccus resinosae attacking Pinus resinosa.

McEwen, P.K., Clow, S., Jervis, M.A. & Kidd, N.A.C. 1993. Alteration in searching behaviour of adult female green lacewings Chrysoperla carnea (Neur.: Chrysopidae) following contact with honeydew of the Black Scale Saissetia oleae (Hom.: Coccidae) and solutions containing acidhydrolysed L-tryptophan. (Great Britain) Entomophaga 38(3):347-354. (In English, French abstract)

Following antennal contact with the honeydew of the black scale, female adult green lacewings showed a reduced mean walking speed (inverse orthokinesis), an increased mean turning frequency (positive klinokinesis), and an increased mean turning angle; behavioral changes occurred after contact with solutions of acid hydrolysed L-tryptophan and water; reduced walking speed, lower mean turning frequency and increased mean turning angle were also observed in insects exposed to honeydew during the period prior to antennal contact with the honeydew; the observed alternations in behavior in response to honeydew could increase the likelihood of both honeydew and prey being located in the field.

McKenna, C.E. & Steven, D. 1993. Phytotoxicity to kiwifruit of oil sprayed after flowering. In Proceedings of the Forty Sixth New Zealand Plant Protection Conference. Christchurch, New Zealand: August 10-12, 1993. Rotorua, New Zealand: pp. 75-79.

Hemiberlesia rapax and H. lataniae are pests of kiwifruit; risk of phytotoxic damage to kiwifruit by a mineral oil used to control these pests was evaluated; single sprays of 1%, 2% and 4% oil were applied at three different periods during the growing season, and under different conditions of humidity and temperature; currently 1% is recommended for field use; fruit were damaged when sprays were applied during a sensitive period, particularly in early January; slow drying conditions and high concentrations of oil increased both the amount and severity of damage; oil was used safely in early December and February.

McLaren, G.F. & Fraser, J.A. 1992. Leafroller and codling moth flights in Central Otago. Orchardist of New Zealand 65(9):21.

Leafrollers and codling moth are the most important insect pests of export pipfruit; the gap between leafroller generations would be an opportunity for pesticide reductions in late January, however, populations of codling moth and crawlers of oystershell scale (Quadraspidiotus ostreaeformis) might increase infestation.

Mendel, Z. The relation of bast scale and bark beetle outbreaks to management of pine plantations in Israel. In Integrated control of scolytid bark beetles / Proceedings of the IUFRO Working Party, edited by T. L. and Saaarenmaa, H. Payne. Vancouver, B. C., Canada: July 4, 1988. (XVII International Congress of Entomology Symposium.) pp. 329-336.

After silvicultural thinning, Orthotomicus erosus and Pityogenes calcaratus are among major insects (scolytids) attacking pine trees injured by the bast scale, Matsucoccus josephi; it is suggested that bark beetle outbreaks are the outcome of the temporary weakening of the trees due to extreme opening of the stand coinciding with high flight aggregation of these beetles; ecological pest management should focus on early thinning integrated with bast scale management.

Mendel, Z., Blumberg, D. & Ishaaya, I. 1991. Effect of buprofezin on Icerya purchasi and Planococcus citri. (Israel) Phytoparasitica 19(2):103-112.

Buprofezin was very effective against crawlers of both species; concentrations of 0.002%, 0.01% and 0.05% (a.i.) resulted in 91-99% nymph mortality of P. citri, whereas 100% mortality was recorded when I. purchasi was treated at 0.05% (a.i.); 3rd instar nymphs of I. purchasi were less susceptible to the chemical; at 0.05%, buprofezin sprayed on adults slightly

(Homoptera: Coccoidea). Systematic Entomology 18(3):237-251; ill.

A new kermesid genus, Eriokermes is described for three species previously placed in the Eriococcidae: Eriokermes gillettei comb. n., E. juniperi comb. n., and E. juniperinus comb. n.; keys to Nearctic kermesid genera, Eriokermes species, and immatures and adults of E. gillettei are provided; four female and five male instars of E. gillettei are described; Eriokermes is placed in Kermesidae based on a cladistic estimate of its phylogenetic position.

Miller, R.H. 1992. Insect pests of wheat and barley of Mediterranean Africa and West Asia. (Syria) Al Awamia (77):3-20. (In English, French & Arabic abstract)

55 insect species have been previously described as pests of wheat and barley in this region; the margarodid scale, Porphyrophora tritici is among those species discussed.

Milne, W.M. 1993. The effect of watering regime on immature stages of Ceroplastes destructor Newstead (Hemiptera: Coccidae). Journal of the Australian Entomological Society 32(3):229-232.

Watering regime did not significantly affect the survival of immature stages of this species, but it did affect rate of development; rate of development was also influenced by host plant species; prolonged exposure to temperatures above 35 degrees C apparently caused high mortality of immature stages on leaves, regardless of water regime.

Minafra, A. & Hadidi, A. 1994. Sensitive detection of grapevine virus A, B, or leafroll-associated II from viruliferous mealybugs and infected tissue by cDNA amplification. Journal of Virological Methods 47:175-188.

This research demonstrated the successful use of PCFR technology to directly detect the grapevine filamentous viruses GVA from viruliferous mealybugs (Pseudococcus longispinus and Planococcus ficus) and GVA, GVB and GVLRA-III from infected grapevine tissue.

Ministry of Agriculture and Natural Resources, Cyprus, Department of Agriculture, Plant Protection, Entomology. 1988. Annual Report for the year 1987. (Nicosia, Cyprus) :37-40.

[Original article not available for abstract.]

Miyanooshita, A. & Kawai, S. 1992. Influence of predation by Mallada boninensis (Okamoto) (Neuroptera: Chrysopidae) and autumn movement of female adults on survival of Ceroplastes japonicus Green (Homoptera: Coccidae), a model experiment with cages. (Japan) Japanese Journal of Applied Entomol. & Zool. 36(3):196-199; ill. (In Japanese, English abstract)

The survival rate of Ceroplastes japonicus on Euonymus japonicus was compared between two groups of test plants; one group was isolated from natural enemies by cages covered with 1- mm mesh net, and the control group lacked cages; females of C. japonicus survived much more on test plants with cages than on controls; active predation by larvae of Mallada boninensis was observed on test plants without cages from July to August, but no other predators were observed; predation by this species is suggested to be a major mortality factor of C. japonicus in summer.

Miyanooshita, A., Kawai, S. & Fujii, K. 1993. Host-associated differences in Aspidiotus cryptomeriae Kuwana (Homoptera: Coccoidea: Diaspididae) I. Adult morphology and host preference. Applied Entomology and Zoology 28(1):71-80; ill.

Morphological differences and host preference in two forms of A. cryptomeriae associated with Cryptomeria japonica and Torreya nucifera; adult males and females showed statistically significant differences in some characters; however, it was impossible to divide specimens perfectly by using any one of these characters; linear discriminant analysis using combinations of several characters successfully discriminated them; present study suggests strongly that these two forms are distinct host races.

Moglan, I. 1988. Natural enemies of the coccid Sphaerolecanium prunastri

reduced fecundity and decreased egg hatch to 31% for I. purchasi and, depending on the exposure period of the females to 49-7% for P. citri; buprofezin at 0.05% exhibited strong ovicidal activity on P. citri, resulting in inhibition of over 80% egg hatch.

Mendel, Z., Blumberg, D. & Wysoki, M. 1992. Biological control of four Homopterans in Israeli horticulture: achievements and problems. (Israel) *Phytoparasitica* 20:45S-49S.

Four phloem-feeding homopterans on citrus and avocado discussed; among them are three scales: Icerya purchasi, Protopulvinaria pyrifomis and Planococcus citri.

Mendel, Z., Blumberg, D., Zehavi, A. & Weissenberg, M. 1992. Some polyphagous Homoptera gain protection from their natural enemies by feeding on the toxic plants Spartium junceum and Erythrina corallodendrum (Leguminosae). (Israel) *Chemoecology* 3:118-124.

Interactions studied among alkaloid-containing legumes and non-toxic plants, several polyphagous homopterans (including Icerya purchasi, I. aegyptiaca, Lepidosaphes ulmi and Planococcus citri, and some major natural enemies of these homopterans; in nature, population growth and density of four of the investigated homopterans are conspicuously high when they developed on the alkaloid containing plant species, and very low on non-alkaloid containing plants; the efficiency of their natural enemies may be reduced by sequestration of alkaloids (or other toxic plant compounds) or their transfer into excreted honeydew.

Mendel, Z. & Lipshitz, N. 1988. Unseasonable latewood and incrustated pits are the cause of drying in Pinus halepensis and P. eldarica infested with Matsucoccus josephi. (Israel) *Journal of Experimental Botany* 39(204):951-959; ill.

A study of the effects of Matsucoccus josephi on water transport in three Pinus species using a scanning electron microscope; transport of the fuchsin dye was arrested below the affected zone of heavily infested shoots, but reached the shoot apex through sparsely infested segments or via segments heavily infested with the first larval stage; description of damage; it is suggested that blocking of water ascent in P. halepensis and P. eldarica starts when female second-instar larvae complete their development and only when population density is relatively high; therefore, it is considered that the accelerated drying of the growth of these two species is directly related to the narrowing of the pit apertures, which resembled those of latewood pits although produced early in the season; the structural modification of the xylem caused by this scale may be related to imbalance in plant growth hormones which are either transmitted with the insect saliva or formed in the plant by salivary enzymes.

Mendel, Z. & Schiller, G. 1993. Biogeography of Matsucoccus josephi Bodenheimer et Harpaz in Crete and mainland Greece. *Ann. Sci. For.* 50:383-388. (In English, French abstract)

Surveys conducted in natural and planted stands of brutia pine (Pinus brutia) and Aleppo pine (P. halepensis) indicate the absence of this species in several locations in Greece.

Millar, J.G. & Hare, J.D. 1993. Identification and synthesis of a kairomone inducing oviposition by the parasitoid Aphytis melinus from California red scale covers. *Journal of Chemical Ecology* 19(8):1721-1736.

The parasitoid wasp Aphytis melinus uses a kairomone from the cover of its scale host, Aonidiella aurantii, as an oviposition stimulant; the kairomone was isolated from extracts of scale covers and identified as O-caffeoyltyrosine by a combination of spectroscopic methods; the kairomone was synthesized, and the synthetic compound was determined to be as active as the chemical isolated from scale covers.

Miller, D.R. & Miller, G.L. 1993. Description of a new genus of scale insect with a discussion of relationships among families related to the Kermesidae

(Homoptera: Coccidae) in Rumania. In Advances in Parasitic Hymenoptera Research. Proceedings of the 2nd Conference on the Taxonomy and Biology of Parasitic Hymenoptera, edited by V. K. Gupta. University of Florida, Gainesville, FL: November 19- 21, 1987. Leiden, New York: E.J. Brill; pp. 389-390.

Five primary parasites and five hyperparasites listed; notes on ecology, biology and distribution.

Monge-Najera, J., Retama, A.P. & Arias, J. 1990. Distribution of scale insects (Homoptera: Coccoidea) on Citrus and eclosion of Aphytis parasitoids (Hymenoptera: Aphelinidae). (Costa Rica) Agronomia Costarricense 14(2):241-246. (In Spanish, English abstract)

Nine scale species observed in grove of orange trees, mandarins and lemon trees; hypothesis that scales prefer the top half of the foliage to favor wind dispersion was rejected for eight species, the exception being Lepidosaphes gloveri; most species were rare in the side protected from the wind during the rainy season; Chrysomphalus sp. (46%) was the most frequent, followed by Lepidosaphes spp. (29%).

Moore, D. & Cross, A.E. 1993. Biological control of the fruit tree mealybug, Rastrococcus invadens Williams; single or multiple introduction. (Great Britain) Acta Horticulturae (341):433-440.

This species was accidentally introduced into West Africa; serious pest of mango and other plants; parasitoid Gyranusoidea tebygi introduced into Togo for successful control; comparison study done between this parasitoid and Anagyrus mangicola; the latter also proved successful and may complement the former.

Morales, C.F. 1991. Margarodidae (Insecta: Hemiptera). Auckland, New Zealand: DSIR Plant Protection. 123 pp.; ill. (Fauna of New Zealand / Ko te Aitanga Pepeke o Aotearoa, edited by Duval, C.T., No. 21.)

This work covers one of the eleven families in New Zealand of the plant-sucking scale insects; morphology; checklist of taxa; taxonomy; biology and life history; host-plant associations; economic importance; key to subfamilies known from New Zealand; keys to life stages and genera of Coelostomidinae known from New Zealand; descriptions; illustrations.

Muniappan, R. 1993. Pests and diseases of Erythrina: a review. Journal of Coffee Research 23(1):1-13.

Among the insect pests discussed are the scale species Icerya purchasi and I. aegyptiaca (Margarodidae).

Mwanza, F. 1993. South American wasp comes to the rescue of cassava growers in Africa. BioScience 43(7):452-453.

Cassava, Manihot esculenta is the dietary mainstay of 200 million people in sub-Saharan Africa; plagued by two nonnative pests: the cassava mealybug, Phenacoccus manihoti, and the cassava green mite, Mononychellus tanajoa; together they cause severe losses in 24 countries; biological control of P. manihoti through the release of Epidinocarsis lopezi has been successful.

Nalepa, C.A., Drea, J.J. & Bryan, M.D. 1993. Release and establishment of Chilocorus kuwanae (Coleoptera: Coccinellidae) in North Carolina. Journal of Entomological Science 28(3):287- 290.

Korean predators, Chilocorus kuwanae, has been imported and successfully established for biological control against Unaspis euonymi, Pseudaulacaspis pentagona, Quadraspidiotus perniciosus, and Melanaspis obscura; Aprostocetus neglectus has also been recorded on test plants.

Neuenschwander, P. 1993. Human interactions in classical biological control of Cassava and Mango mealybugs on subsistence farms in tropical Africa. In Crop Protection Strategies for Subsistence Farmers. Miguel A. Altieri, ed. Boulder, CO: Westview Press. pp. 143-177. (Westview studies in insect biology.)

Discussion of crop protection techniques in common use and modern

scientific and technological improvements, using examples of Epidinocarsis lopezi controlling Phenacoccus manihoti, and Gyranoidea tebyqi controlling Rastrococcus invadens; history of the projects; review of recent research; releases and monitoring of beneficials; the sociological context; 10-page bibliography.

Neuenschwander, P., Borowka, R., Phiri, G., Hammans, H., Nyirenda, S., Kapeya, E.H. & Gadabu, A. 1991. Biological control of the cassava mealybug Phenacoccus manihoti (Hom., Pseudococcidae) by Epidinocarsis lopezi (Hym., Encyrtidae) in Malawi. *Biocontrol Science and Technology* 1(4):297-310.

In a multiple regression analysis involving 29 meteorological, agronomic and plant variables from 476 fields, the duration of E. lopezi's presence was the major factor influencing CM population densities; overall, satisfactory control was achieved by E. lopezi in all but a few fields concentrated on extremely poor soils characterized by sand dune vegetation; discussion of socioeconomic implications of this program.

Nielsen, D.G. & King, J.E. 1992. Control of ornamental-plant pests in Ohio with pageant and Dursban insecticides. *Down to Earth* 47(2):19-23.

Among the ten pests against which these seven insecticides were evaluated and compared to water, are two scale species: Chionaspis heterophyllae and Unaspis euonymi.

Nucifora, S. 1991. Rungaspis capparidis (Bodenheimer) in Genistinae and Capparidaceae in Pantelleria and in Sicily (Homoptera: Diaspididae). (Rungaspis capparidis (Bodenheimer) su genistinae e capparidaceae in Pantelleria e in Sicilia (Homoptera: Diaspididae).) In *Atti XVI Congresso Nazionale Italiano di Entomologia*. Italy: 533-536. (In Italian, English abstract)

Report on the occurrence of this species; host plants include Retama raetam, Capparis spinosa, C. galeata, C. cartilaginea, Genista aspalathoides, Calotropis procera and Zygophyllum dimosum.

Olson, M.H., Blank, R.H. & Lo, P.L. 1993. The phenology of soft wax scale Ceroplastes destructor (Hemiptera: Coccidae) on tangelo in Kerikeri. *New Zealand Entomologist* 16:25-29.

Observation of this scale species on citrus (Citrus paradisi) in successive seasons; intended to provide a useful starting point from which to devise biological and/or insecticidal strategies for control.

Oppenheim, D. & Lindman, N. 1993. A preliminary study on the ecology and chemical control of the pear psylla, Cacopsylla bidens (Sulc), in the Upper Galilee, Israel. *Alon Hanotea* 47(7): 337-343. (In Hebrew)

This species was recently recorded for the first time in Israel; recorded on fruit spurs of pear; chemical control recommendations.

Orphanides, G.M. 1993. Control of Saissetia oleae (Hom.: Coccidae) in Cyprus through establishment of Metaphycus bartletti and M. helvolus (Hym.: Encyrtidae). *Entomophaga* 38(2):235-239.

In Cyprus the black scale is a pest primarily of olive, Olea europaea, but it also attacks several other plants, among which are Citrus spp. and oleander, Nerium oleander; parasitoids Metaphycus bartletti and M. helvolus have been imported from France, massreared and permanently established in Cyprus; following limited releases of these parasitoids, populations of S. oleae have been reduced from outbreak levels to almost non-existence and remained at such low levels even after discontinuation of these releases.

Pelletier, D.L. & Msukwa, L.A.H. 1990. Intervention planning in response to disasters: a case study of the mealybug disaster in Malawi. Ithaca, New York: Cornell Food and Nutrition Policy Program. 54 pp. (Monograph, 6.)

This report discusses the background of Phenacoccus manihoti presence in Malawi and its pest status against cassava, description of the survey conducted and its objectives, nutritional status, cropping patterns and the potentials and requirements for change, knowledge and practices concerning methods to minimize cassava damage, socioeconomic characteristics and

options for targeting food assistance to vulnerable groups, role of quantitative survey information in project planning and intervention strategies.

- Perez Guerra, G. & Kosztarab, M. March 1992. Biosystematics of the family Dactylopiidae (Homoptera: Coccinea) with emphasis on the life cycle of Dactylopius coccus Costa. Blacksburg, VA: Virginia Agricultural Experiment Station, Virginia Polytechnic Institute and State University. 90 pp.; ill. (Studies on the Morphology and Systematics of Scale Insects, No. 16.) [Bulletin 92-1.]

Review of the nine species of this family; redescrptions and illustrations; economic value; hosts; natural enemies; distributions; etymologies; roles as biological control agents.

- Perruso, J.D. & Cassino, P.C.R. 1993. Population dynamic of Selenaspidus articulatus (Morg.) Homoptera: Diaspididae) on Citrus sinensis (L.) in Rio de Janeiro. (Flutuacao populacional de Selenaspidus articulatus (Morg.) (Homoptera: Diaspididae) em Citrus sinensis (L.) no estado do Rio de Janeiro.) (Brazil) Anais da Sociedade Entomologica do Brasil 22(2):401-404. (In Portuguese, English abstract)

Expressive regularity in the population dynamic of S. articulatus observed; highest infestations from September to January.

- Pijls, J.W.A.M., Poleij, L.M. & Van Alphen, J.J.M. 1993. Interspecific interference between Epidinocarsis lopezi and E. diversicornis, parasitoids of the Cassava mealybug Phenacoccus manihoti. (the Netherlands) Mededelingen Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent 58(2B):551-560.

E. lopezi and E. diversicornis have been introduced in Africa for the biological control of the cassava mealybug; competition between the two investigated; patch area per parasitoid and number of hosts available to each parasitoid were equal in all treatments; although the interaction rate with other wasps increases with increasing number of parasitoids on the patch, and changes in patch time, encounter rate with hosts and behavior occur, results show that there is no net effect of the simultaneous presence of non-conspecifics on the rate of offspring production in both species; interspecific interference does not influence the possibilities for coexistence of E. lopezi and E. diversicornis on P. manihoti.

- Pless, C.D., Deyton, D.E. & Sams, C.E. 1993. Vegetable oil applications control scale insects on dormant apple and peach trees. HortScience 28(5):231. [Abstract of a presentation at the 90th Annual Meeting of the American Society for Horticultural Science, Nashville, TN, July 24-29, 1993.]

Responses of Terrapin scale, Lecanium nigrofasciatum, and San Jose scale, Quadraspidiotus perniciosus infestations to vegetable oil treatments.

- Porcelli, F. 1992/93. Functional morphology of "diamond-shaped sensilla" on males of Unaspis euonymi (Comstock) (Coccoidea: Diaspididae). (Ultrastruttura e funzione dei "diamond-shaped sensilla" nei maschi di Unaspis euonymi (Comstock) (Coccoidea: Diaspididae).) (Italy) Entomologica (Bari) 27:19-28; ill. (In Italian, English abstract)

Behavioral observations led to hypothesis that laterally located sensilla are stimulated during walking or leg movement; furthermore, the ventrally located sensillum monitors cuticular strains due to the contraction of the elevator trochanteris muscle.

- Pramanik, A. & Ghose, S.K. 1991. Observations on the biology of the mango mealybug, Rastrococcus iceryoides (Green) (Pseudococcidae, Homoptera). Annals of Entomology 9(1):25-30.

Seven new host plants of this species are recorded; biology; sex ratio; adult females are effectively controlled by three species of chalcidoid parasitoids and the grubs of a coccinellid, Scymnus sp.; eggs are consumed by those grubs and the maggots of a cecidomyiid fly.

Prasad, S., Singh, D.R. & Williams, P. 1991. Bioefficacy of some important insecticides against female mealybugs, Drosicha stebbingi (Green). (India) Bioed 2(2):135-138.

Effectiveness of 15 different insecticides against females of this mealybug studied under laboratory conditions.

Prasad, Y.K. 1991. A self-regulating leaf-disc system for the culture of sap-feeding insects. Indian Journal of Entomology 53(1):70-72; ill.

This self-regulating leaf-disc system was developed for the culture of Icerya purchasi (Homoptera: Margarodidae) using citrus leaves; it can also be used for other sap feeding insects, but is most suited where space is limited, for experiments with large number of replicates, and where there is need to transfer sessile sap feeding insects.

Prasada Rao, V.L.V., Venugopala Rao, N. & Muralidhara Rao, G. 1991. Effect of trashing and insecticidal application on control of scale insect (Melanaspis glomerata) of sugarcane (Saccharum officinarum). Indian Journal of Agricultural Sciences 61(7):516- 520.

Field experiment examines relative efficacy of 11 treatments (chemical and trashing) on spread and intensity of these scale species on sugarcane; although differences in yield of sugarcane and quality of juice among treatments were not significant, the effect of seasonal variations on these parameters was perceptible.

Prathapan, K.D. 1992. Incidence of Drosicha mangiferae (Green) (Homoptera: Margarodidae) on Cannabis sativa L. (Cannabinaceae). (India) Entomon 17(1/2):139.

This giant mealybug is a pest of mango and other fruit trees and forest trees in northern and central India; recorded on more than 75 host plants; previously found on cocoa; this is the first record on hemp, C. sativa, an annual plant.

Predata, P.A. & Viggiani, G. 1991. Preliminary morpho-biological observations on Azotus perspicuosus (Girault) (Hymenoptera: Aphelinidae), hyperparasitoid of Pseudaulacaspis pentagona (Targioni, Tozzetti) (Homoptera: Diaspididae). (Italy) Redia 74(3):343-350; ill.

[Proceedings of a paper presented at Insect Parasitoids, the 4th European Workshop, held in Perugia on April 3-5, 1991.]

The hyperparasitoid, A. perspicuosus, attacks all primary parasitoids of Pseudaulacaspis pentagona; descriptions and biology of hyperparasitoid.

Prestidge, R.A., Holland, P.T., Clarke, A.D. & Malcolm, C.P. 1989. Pesticides for use close to and during harvest of persimmons. In Proceedings of the Forty Second New Zealand Weed and Pest Control Conference. Taranki Country Lodge, New Plymouth, New Zealand: August 8-10, 1989. Palmerston North, New Zealand: pp. 195-199.

In a survey of the pest incidence on persimmons (Diospyros kaki) mealybugs, thrips and leafroller larvae were the most common insects; chemical treatments discussed.

Quirce, S., Cuevas, M., Olaguibel, J.M. & Tabar, A.I. 1994. Occupational asthma and immunologic responses induced by inhaled carmine among employees at a factory making natural dyes. Journal of Allergy and Clinical Immunology 93(1 Part 1):44-52.

Carmine is a red dye extracted from the dried females of Dactylopius coccus var. costa (cochineal); this study evaluates its potential for allergic responses through skin testing and determination of serum-specific IgE and IgG subclass antibodies by RAST and ELISA, respectively; findings suggest that carmine can elicit allergic responses.

Raguraman, S., Saroja, R. & Manickavasagam, S. 1991. New parasitoid record on the rice mealy bug, Brevinnia rehi Lindinger (Pseudococcidae: Hemiptera). Indian Journal of Entomology 53(1): 170-171.

This species is an important pest of rice in India; infestation encouraged by dry weather, bad drainage and poor soil; description of

damage; natural enemies.

Rai, K.M., Patel, K.G., Jhala, R.C. & Patel, C.B. 1992. Chemical control of mealybug, Coccidohystrix insolita (Green) (Pseudococcidae: Homoptera) infesting pigeonpea in South Gujarat area. (India) Gujarat Agricultural University Research Journal 17(2):72-75.

Several insecticides tested for effectiveness against this mealybug, a major pest of Cajanus cajan, an important pulse crop in this region.

Raman, A. & Takagi, S. 1992. Galls induced on Hopea-ponga Dipterocarpaceae in southern India and the gall-maker belonging to the Beesoniidae (Homoptera: Coccoidea). (India) Insecta Matsumurana (47):1-32; ill.

Spherical echinate galls are induced by Mangalorea hopeae on Hopea ponga in leaf axils through modification of the vegetative bud which develops into a massive columella: differentiation and development of leaf primordia are completely arrested, but the surface initials of the columella develop into multicellular echinate appendages; each mature gall contains only one female, whereas a number of male insects occur on their maternal gall, occupying spaces between echinate appendages.

Ramani, R. & Sharma, K.K. 1991. A review of some genetical aspects of lac insects. (India) Annals of Entomology 9(2):47-53.

Lac insect taxonomy (Tachardiidae (=Kerriidae)), chromosome system and evolution in relation to other scale insect groups; sex determination and gene expression; scope of genetic improvement of lac resin color.

Rao, V.L.V.P. & Rao, N.V. 1990. Utility of trashing and insecticidal application in the control of the scale insect (Melanaspis glomerata G.) on sugarcane. (India) Cooperative Sugar 22(3):173-175.

M. glomerata is a major pest of sugarcane; effectiveness of 12 treatments tested.

Rao, V.L.V.P. & Rao, N.V. 1992. Efficacy of soil application of some insecticides in controlling scale insect (Melanaspis glomerata Green) on sugarcane ratoon. Indian Journal of Plant Protection 20(2):125-128.

Scale insect infestation attained maximum intensity by eight months after crop emergency; differences in scale infestation in the treatments as well as control plots were not significant indicating that soil application of insecticides in pockets at ratooning could not check primary source of infestation in the stubbles.

Rawat, U.S. & Pawar, A.D. 1992. Biocontrol of San Jose scale, Quadraspidiotus perniciosus (Comstock) by predatory beetle, Chilocorus bijugus Mulsant in Himachal Pradesh. (India) Plant Protection Bulletin (Faridabad) 44(4):7-10.

Pest in the five main apple growing areas in India; laboratory bred adult predatory beetles, C. bijugus were repeatedly released in these problem areas; results were viewed as promising and practical; release made in summer gave better results than those made in autumn or the rainy season.

Rawat, U.S., Sangal, S.K. & Pawar, A.D. 1992. Development of Chilocorus bijugus Mulsant, a predator of San Jose scale, Quadraspidiotus perniciosus (Comstock) at different levels of temperature and relative humidity. (India) Journal of Insect Science 5(2):137-140.

Eggs of this scale predator did not hatch at 13 degrees and 38 degrees C; discussion of optimum conditions for survival and development.

Renard, S. 1993. Sensorial equipment and effect of the host-plant on the fixation behaviour of the Cassava mealybug Phenacoccus manihoti Matile-Ferrero (Homoptera, Pseudococcidae). Belgian Journal of Zoology 123 - Suppl. 1:61-62. [Abstracts of the Third Belgian Congress of Zoology held November 5-6, 1993, in Liege, Belgium]

Behavior of this mealybug on its host plant, Cassava, Manihot esculenta studied by video camera and T.E.M. and S.E.M.

Robinson, W.H. 1991. Insect pests of minor importance. FDA Technical Bulletin 4:81-84.

Recognition of insect pests generally considered of minor importance are, nevertheless, significant to the food industry; non-technical review of descriptions, pest status, biology and habits, predators, parasites and pathogens of six types of insects including scale, aphids, and thrips.

Robredo, F. & Cadahia, D. 1992. Protection against forest diseases and insects. (Proteccion contra las enfermedades e insectos forestales.) (Spain) Bol. Sanid. Veg. Plagas 18(3):555- 567; ill. (In Spanish, English abstract)

Analysis of the main phytopathological problems currently encountered in forests; Hemiberlesia pitysophila on Pinus massoniana is among the pests discussed.

Rosen, D. 1993. Parasitic Hymenoptera in biological control of the genus Aphytis. In Advances in Parasitic Hymenoptera Research: Proceedings of the II Conference on the Taxonomy and Biology of Parasitic Hymenoptera, edited by V. K. Gupta. University of Florida, Gainesville, FL: November 19-21, 1987. Leiden, Netherlands: Brill; pp. 411-416.

Review of the most successful primary ectoparasites (Aphytis) of armored scale insects (Diaspididae) such as Chrysomphalus aonidum, Lepidosaphes beckii, Unaspis citri, Aonidiella aurantii, Parlatoria oleae, Selenaspidus articulatus and Unaspis yanonensis.

Rosenheim, J.A. & Rosen, D. 1992. Influence of egg load and host size on host-feeding behaviour of the parasitoid Aphytis lingnanensis. Ecological Entomology 17:263-272.

Aphytis spp. are gregarious ectoparasitoids of armoured scale insects (Homoptera: Diaspididae); in this experiment, parasitoids were reared on Aspidiotus nerii and Aonidiella aurantii (both grown on Cucurbita moschata).

Russo, A. 1994. A new species of Phenacoccus Cockerell (Homoptera: Coccoidea: Pseudococcidae) on fir-tree (Abies alba Miller) from Italy. (Italy) Annls. Soc. ent. Fr. (N.S.) 30(3): 279-282; ill. (In English, French abstract)

Description and illustration of adult female of Phenacoccus longoi, new sp.; key to nine species of genus provided.

Sadakathulla, S. 1993. Technique of mass production of the predatory coccinellid, Chilocorus nigritus (Fabricius) on coconut scale, Aspidiotus destructor Sign. (India) Indian Coconut Journal 23(9):12-13; ill.

This scale was mass cultured in vitro on pumpkin, Cucurbita maxima, then transferred to fresh coconut leaves; this species is a major sucking pest on many crops in the tropics; the effective predation of the adult coccinellid examined.

Salazar Torres, J.C. & Solis Aguilar, J.F. 1990. Scale insects (Homoptera: Coccoidea) present on four species of fruit trees of the family Rosaceae in Zacatlan, Puebla. (Escamas (Homoptera: Coccoidea) presentes en cuatro especies frutales de la familia Rosaceae en Zacatlan, Puebla.) (Mexico) Revista Chapingo 15(67- 68):135-137. (In Spanish, English abstract)

Survey shows eight scale species from apples, pears, plums and peaches: Pseudococcus longispinus, P. maritimus, Coccus hesperidum, Lecanium persicae, Aspidiotus nerii, Diaspidiotus ancylos, Hemiberlesia rapax and Quadraspidotus perniciosus; natural enemies and effect of rain on populations observed.

Semisi, S.T., Braune, H., Peters, A.M. & Iosefa, T. 1992. Integrated pest management in Western Samoa. In Integrated Pest Management in the Asia Pacific Region. Wallingford, UK: CAB International. pp. 383-398.

Review of the agricultural sector, institutional set-up and national policy on IPM; among the case studies described is the white peach scale, Pseudaulacaspis pentagona on passion fruit; predators.

Sharma, G.C. & Sharma, K.C. 1993. Pulvinaria vitis (L.), a new record of scale insect on poplar in India. Journal of Entomological Research (New Delhi) 17(3):227-228.

This scale found on Populus ciliata in India for the first time; also

distributed in Europe, Asia, Japan and North America; in the U.K. it is widely distributed on the bark of many kinds of woody plants; biology.

- Shi, B. 1993. On the climatic zones for lac insects along with their evaluation and exploitation in Yunnan China. *Forest Research* 6(4):437-443. (In Chinese, English abstract)

Three regions and three different altitude zones defined; conditions relating to these regions described and related to the distribution and arrangement of lac production.

- Shi, Z. 1990. A new species and a new record of genus Blastothrix (Hymenoptera: Encyrtidae) in China. (China) *Acta Entomologica Sinica* 33(4):462-465; ill. (In Chinese, English abstract)

Blastothrix chinensis reared on scale species Kermococcus nawae; B. longipennis recorded on Parthenolecanium corni, P. pruinosum, P. quercifex and P. fletcheri.

- Sinha, P.K., Dinesh, D.S. & Gupta, M.L. 1992. Preliminary field observation on the population fluctuation of mango scale Chloropulvinaria polygonata (Ckll.) (Homoptera: Coccidae) at Bhagalpur. *Proceedings, National Academy of Sciences, India* 62(B)(4):543-546.

This research observes parasitization by Aneristus ceroplastae, as well as atmospheric temperature and seasonal changes on the population decline of this scale species.

- Sinha, P.K., Sayeed, M.Z. & Dinesh, D.S. 1985. A report on the mealybugs (Homoptera: Pseudococcidae), their host plants and natural enemies at Bhagalpur. *Proceedings, National Academy of Sciences, India* 55 (B)(II)

Survey of fruit orchards and gardens at Ishagalpur, during 1981-83 has shown the presence of the following mealybug species -- Ferrisia virgata, Rastrococcus iceryoides, Nipaecoccus viridis, Antonina graminis and Planococcoides robustus; host plants; predators and parasites.

- Soria, S., Cadahia, D. & Munoz, A. 1993. The genus Carulaspis Mac Gillivray, 1921 (Homoptera, Diaspididae) in the gardens of Patrimonio Nacional. (El genero Carulaspis Mac Gillivray, 1921 (Homoptera, Diaspididae) en los jardines del Patrimonio Nacional.) (Spain) *Bol. Sanid. Veg. Plagas* 19(2):273-284; ill. (In Spanish, English abstract)

This report confirms the presence of Carulaspis juniperi and C. carueli on Sequoiadendrom giganteum at these gardens in central Spain; also, Carulaspis has been recorded on Viscum album (mistletoe) elsewhere in Spain; key to adult females of Carulaspis species found in Spain; hosts.

- Spollen, K.M. & Hoy, M.A. 1993. Laboratory-selected California red scale parasite is resistant to Sevin. *California Agriculture* 47(1):16-19; ill.

Aphytis melinus, a Sevin-resistant parasite of Aonidiella aurantii, is cross resistant to several citrus pesticides and is ready for implementation in citrus integrated pest management (IPM) systems.

- Squerens, N., Tondeur, R., Verstraeten, Ch. & Schiffers, B.C. 1992. Control of a soft scale of ornamental plants (Eupulvinaria hydrangeae Steinweden) (Homoptera: Coccidae) using an insect growth regulator: fenoxycarb. (Lutte contre la cochenille pulvinaire de l'hortensia (Eupulvinaria hydrangeae Steinweden) (Homoptera: Coccidae) a l'aide d'un regulateur de croissance des insectes: le fenoxycarbe.) (Belgium) *Mededelingen van de Faculteit Landbouwwetenschappen, Rijksuniversiteit Gent* 57(3A): 791-800. (In French, English abstract)

Investigation of the efficacy of fenoxycarb in three concentrations in combatting this soft scale; causes serious damage on many ornamental plants; results show differences between treatments.

- Stevens, P.S., Steven, D., Malcolm, C. & Holland, P.T. 1993. Reducing pesticide residues on kiwifruit. In *Proceedings of the Forty Sixth New Zealand Plant Protection Conference*. Rotorua, New Zealand: 10-12 August 1993. New Zealand: New Zealand Plant Protection Society; p. 62-66.

An approach to reducing pesticide residues on kiwifruit without

compromising fruit quality has been validated; late season spray decisions were based on field monitoring of armoured scale insect populations at 12 sites during March and April; the final insecticide sprays could be omitted as scale numbers on leaf samples from all sites never exceeded an 8% spray threshold; fruit from vines receiving reduced spray programs had lower residues than fruit receiving a full season program; there were no significant increases in scale infestation or leafroller caterpillar damage on fruit at harvest.

Stewart, T.M., Norton, G.A., Mumford, J.D. & Fenemore, P.G. 1993. Pest and disease decision support for Hawkes Bay apple growers -- a survey. In Proceedings of the Forty Sixth New Zealand Plant Protection Conference. Christchurch, New Zealand: August 10-12 1993. Rotorua, New Zealand: New Zealand Plant Protection Society; p. 152-161.

An interview survey was conducted among 50 randomly selected Hawkes Bay apple growers to determine their present pest and disease problems, use of existing IPM methodology and requirements for an improved decision-support service; more than 20% of growers had difficulties with several pests including mealybugs (Pseudococcus spp.).

Stratopoulou, E.T. & Kapatos, E.T. 1990. Population dynamics of Saissetia oleae. I. Assessments of population and mortality. (Greece) Entomologia Hellenica (8):53-58. (In English, Greek abstract) [Original article not available for abstract.]

Survivorship curves were constructed for this species on olive in Corfu; major mortality factors were high temperatures in summer, the action of natural enemies, especially predatory coccinellids and the parasitoid Metaphycus helvolus during the spring.

Subramanian, G.B.V. & Bhushan Kumar Hari. 1993. Aleuritic acid in perfumery and pheromones. (India) Perfumer & Flavorist 18(4):41- 44.

A description of the utility of organic compounds and their derivatives that are found in the resin secreted by Lacifer lacca Kerr, lac insect, a native of India and Thailand; this resin has traditionally been manufactured commercially to produce shellac.

Sugiura, N. & Takagi, M. 1992. Multiparasitism of Unaspis Yanonensis Debach et Rosen and Coccobius fulvus (Compere et Annecke) in the field. Proceedings of the Association for Plant Protection of Kyushu 38:163-165.

Multiparasitism was observed from August to September, when the host population declined and the percentage parasitism by A. yanonensis increased; maximum percentage of multiparasitism was 10%; it is suggested that the percentage of multiparasitism was too low to have a deleterious effect on the biological control of U. yanonensis.

Sutton, M.Q. 1990. Notes on a creosote lac scale insect resin as a mastic and sealant in southwestern Great Basin. Journal of California and Great Basin Anthropology 12(2):262-268; ill.

Tachardiella larrae found on branches of the creosote bush, Larrea tridentata; distribution and biology; technology of resin; ethnographic and archaeological data.

Swaminathan, R. & Verma, S.K. 1991. Studies on the incidence of date palm scale, Parlatoria blanchardi (Targ.) in western Rajasthan. (India) Entomon 16(3):217-221.

Study of this important pest of date palm in this arid region; older leaves and upper leaf surfaces preferred, but tips invariably remained free from infestation; effect of seasonal variation, temperature and relative humidity on incidence and concentration discussed; trials of varietal resistance.

Takagi, S. 1993. Primitive Diaspidini (Homoptera: Coccoidea: Diaspididae). (Japan) Insecta Matsumurana 49 (new series):1-67; ill.

Eight new scale species described from Malaysia, and 4 new genera erected: Dungunia, Kyphosoma, Pentacicola, and Thoa; descriptions; hosts;

keys.

- Takagi, S. & Miyatake, Y. 1993. SEM observations on two lerp-forming Psylloids (Homoptera). (Japan) *Insecta Matsumurana* (49): 69-104; ill.
- The lerps of Celtisaspis usubai and Macrohomotoma sp. from the Philippines are similar to the tests of Conchaspis in external appearance and internal structure; it is suggested that wax-secreting organs are useful for phylogenetic study in the Psylloidea, and also that coverings of homopterous insects and their formation are worthy of study from the viewpoint of adaptation and phylogeny.
- Tan, Y. & Zheng, Z. 1992. A new species of Microterys Thomson (Hymenoptera: Encyrtidae) from Yunnan, Southwest China. *Entomotaxonomia* 14(4):285-288; ill. (In Chinese, English abstract)
- This newly described encyrtid was reared from Ceroplastes sp. on Thevetia peruviana.
- Tang, S., Qin, H. & Wang, D. 1990. Study on Aspidiotus chinensis Kuw. et Mur. *Journal of Shanghai Agricultural College* 8(3):187-194. (In Chinese, English abstract)
- Biology; pesticide evaluation and recommendations for effective use.
- Thakur, J.N., Pawar, A.D. & Rawat, U.S. 1993. Introduction, colonisation and new records of some biocontrol agents of San Jose scale, Quadraspidiotus perniciosus Comstock (Hemiptera: Coccidae) in Kullu Valley, H. P., India. *Journal of Biological Control* 7(2):99-101.
- Common name: San Jose scale; serious pest of temperate fruits; worldwide distribution; recorded on more than 200 plant species; causes economic losses in India on apple, plum and pear; previous unsuccessful attempts have been made to establish Aphytis diaspidis and Encarsia perniciosi for control; other biocontrol agents being tested include Azotus kashmirensis, A. perspicuosus, Aphytis proclia, Teleterebratus perversus, Chilocorus bijugus, Coccinella septempunctata, Oenopia sauzei, Pharoscyrnus flexibilis and Sticholotis marginalis.
- Toccafondi, P., Covassi, M. & Pennacchio, F. 1991. Studies on the entomophagous predators of scale insects of the genus Matsucoccus Cock. in Italy. II Bio-ethological notes on Rhyzobius chrysomeloides (Herbst) in pine forests of Liguria (Coleoptera: Coccinellidae). *Redia* 74(2):599-620; ill. (In Italian, English abstract)
- Included in this study are host records on which this species preys, such as Matsucoccus feytaudi, Lichtensia viburni and Ceroplastes japonicus.
- Tomkins, A.R. 1992. Teflubenzuron and Phosalone alone and in combination for pest control on kiwifruit: I. Armoured scale insects. In *Proceedings of the Forty Fifth New Zealand Plant Protection Conference*, edited by A. J. Popay. Wellington, New Zealand: August 11-13, 1992. Rotorua, New Zealand: pp. 151-155.
- Field trials were conducted to evaluate these insecticides for control of Hemiberlesia rapax and Aspidiotus nerii; neither phosalone or teflubenzuron, alone or in combination, gave economically acceptable control at the rates tested.
- Tomkins, A.R., Greaves, A.J., Wilson, D.J. & Thomson, C. 1992. Field evaluation of Avermectin B1 for pest control on kiwifruit. In *Proceedings of the Forty Fifth New Zealand Plant Protection Conference*, edited by A. J. Popay. Wellington, New Zealand: August 11-13, 1992. Rotorua, New Zealand: pp. 146-150.
- A trial was conducted in the 1989-90 season to evaluate avermectin B1 used full season for kiwifruit pest control; infestation by mites and thrips reduced; armoured scale insects such as Hemiberlesia rapax and Aspidiotus nerii are also pests of kiwifruit.
- Tondeur, R., Merlin, J., Schiffers, B.C., Verstraeten, Ch. & Squerens, N. 1993. Ability of amitraz to maintain the predator Exochomus quadripustulatus L. (Col., Coccinellidae) in an integrated management of Eupulvinaria hydrangeae

Steinw. (Hom., Coccidae). (Belgium) Journal of Applied Entomology 115(1):14-24. (In English, German abstract)

Selectivity of Exochomus quadripustulatus was studied in the laboratory (by means of three complementary methods) and the effects of amitraz spraying on the predator populations were evaluated under natural conditions; it was found that spraying induced a decrease in the number of E. quadripustulatus although there was no way of distinguishing between mortality and dispersal; however, the decrease of the predator is at worst in the same order of magnitude as for its prey; results indicate that one formulation of amitraz used could be a useful component in an integrated pest management scheme.

Troncho, P., Rodrigo, E., Garcia-Mari, F. & Troncho, P. 1992. Observations on the parasitism of the Diaspids Aonidiella aurantii (Maskell), Lepidosaphes beckii (Newman) and Parlatoria pergandei (Comstock) in an orange grove. (Spain) Bol. Sanid. Veg. Plagas 18(1):11-30; ill. (In Spanish, English abstract)

Insect hosts from branches, leaves, and fruits, and also parasites from yellow sticky traps, have been sampled regularly in 1988 and 1990; four species of Aphytis identified from traps and examined.

Ullah, G.M.R. 1992. Seasonal effects on the rate of development and fecundity of scale insects, Pulvinaria psidii Maskell and Pulvinaria floccifera (Westwood) (Homoptera: Coccidae). (Bangladesh) Annals of Entomology 10(2):7-11.

Adult females of these two species collected from Psidium guajava and other host plants; life cycles observed.

Ullah, G.M.R., Chowdhury, M.S.K. & Bhuiyain, A.M. 1992. Variations in the rate of development of two sexes of Rastrococcus spinosus (Robinson) on various host plants. (Bangladesh) Annals of Entomology 10(1):5-7.

Life cycles of this species studied in laboratory cultures on different host plants such as Citrus lemon, Psidium guajava and Mangifera indica; duration of developmental stages varied on different host plants.

Ullah, G.M.R. & Chowdhury, S.H. 1991. Biology of Pulvinaria floccifera Westwood (Coccidae, Coccoidea). Chittagong University Studies 15(1):1-16. (Part II Science.) [Original article not available for abstract.]

Ullah, G.M.R. & Parveen, A. 1993. Coccoid pests (scale insects and mealybugs) and their host-plants on Chittagong University campus -- a check list. Bangladesh Journal of Zoology 21(1):181-182.

Seven species identified from Margarodidae, Pseudococcidae and Coccidae families.

Ullah, G.M.R., Alam, M.S. & Das, H.R. 1993. Some aspects of biology of pineapple mealybug, Dysmicoccus brevipes (Cockerell) (Homoptera: Pseudococcidae). (Bangladesh) Chittagong University Studies 17(1):77-81.

Reared on fresh guava leaves (Psidium guajava), in glass covered petridishes; duration of developmental stages observed.

Varshney, R.K. 1993. On the authorship of Diaspis lanatus (Homoptera: Diaspididae). (India) Oriental Insects 27:271-272.

This paper asserts that authorship of this species is erroneously ascribed either to Morgan, 1892 or Morgan & Cockerell, 1892; it should be Cockerell (1892).

Walker, J.T.S., White, V. & Charles, J.G. 1993. Field control of Chlorpyrifos-resistant mealybugs (Pseudococcus affinis) in a Hawkes Bay orchard. In Proceedings of the Forty Sixth New Zealand Plant Protection Conference. Christchurch, New Zealand: August 10-12, 1993. Rotorua, New Zealand: pp. 126-128.

A field trial was conducted to evaluate insecticide resistance in mealybugs in a pear orchard; buprofezin was the only treatment giving a significant level of control of Pseudococcus affinis.

Wang, T. 1994. Economic insect fauna of China: Homoptera: Coccoidea: Coccidae,

Asterolecaniidae, Lecanodiaspididae, Cerococcidae, Aclerididae. Beijing, China: Science Press. 302 pp.; ill. (Vol. 43.) (In Chinese)

Review of 131 species from 43 families.

Waterhouse, D.F. 1993. Icerya aegyptiaca (Douglas). In Biological control: Pacific prospects -- Supplement 2. Canberra, Australia: Australian Centre for International Agricultural Research. pp. 49-63; ill. (ACIAR Monograph, No. 20.)

Detailed review of origin, distribution, host plants, natural enemies, biological control, life cycle, and pest status of this member of Margarodidae family.

Watson, J.K., Lambdin, P.L. & Langdon, K. 1994. Diversity of scale insects (Homoptera: Coccoidae) in the Great Smoky Mountains National Park. Annals of the Entomological Society of America 87(2):225-230.

Fifty-three species from the families Asterolecaniidae, Cerococcidae, Coccidae, Diaspididae, Margarodidae, and Pseudococcidae were collected from 56 host plants in the Great Smoky Mountains National Park; distribution of coccoids was shown to be correlated to host availability and host distribution along an elevational gradient; certain coccoid taxa were oligophagous and restricted to the elevational range of their host, but most species were polyphagous and were collected at several elevational gradients; the number of species and family taxa declined as elevation increased; also, the heaviest infestations occurred in disturbed areas; the Shannon-Weaver diversity values for species collected ranged from 0.017 (rare) to 0.216 (abundant); two species were classified as abundant, four very common, six common, and the remaining 41 species uncommon to rare; the most common species collected was the European fruit lecanium, Parthenolecanium corni.

Wigg, D. 1993. Quiet revolutionaries: a look at the campaign by agricultural scientists to fight hunger (... and how the much-neglected cassava could help). Washington, D. C.: International Bank for Reconstruction and Development/the World Bank. 57 pp. (World Bank development essays, 2.)

This campaign to fight hunger focusses on defeating the cassava mealybug (Phenacoccus manihoti and P. herreni) and other cassava pests in Africa; brief history of cassava cultivation and mealybug infestation; review of the search for an effective natural enemy for biological control and eventual location of Epidinocarsis lopezi; other discussions include improved cassava varieties, quarantine, germplasm preservation for genetic diversity, storage, and cooking.

Williams, D.J. 1994. Distribution of the Pacific coconut mealybug, Dysmicoccus cocotis (Maskell) and of a new related species on coconut in Southern Asia (Homoptera: Coccoidea: Pseudococcidae). Journal of Natural History 28(2):365-371; ill.

Description of a new species of mealybug from southern Asia, Dysmicoccus finitimus; this and D. cocotis are both common on coconut; distributions in southern Asia.

Williams, D.J. & Watson, G.W. 1993. Aulacaspis (Homoptera: Diaspididae) on sugarcane and other Saccharum spp. (Gramineae). (New Guinea) Bulletin of Entomological Research 83(4):649-654; ill.

Six species of this genus briefly reviewed, including A. neoquineensis, new sp.; references to original descriptions; distributions; taxonomic notes; brief descriptions; key provided.

Williams, M.L. 1993. Toumeyella lignumvitae, a new species of scale insect from the Florida keys (Homoptera: Coccidae). Florida Entomologist 76(4):566-572; ill. (In English, Spanish abstract)

Known only from Guaiacum sanctum, a tree found in the Florida keys; associated with the ants, Camponotus abdominalis floridanus and Wasmannia auropunctata, and one caterpillar, Laetilia coccidivora; description; key to five Toumeyella species.

Witte, H. & Lein, K.A. 1992. Influence of crop protection measures on overwintering stages of insect pests and their parasitization in apple growing. (Germany) Pflanzenschutz- Nachrichten Bayer 45(2):239-276; ill. (In English, German, French & Spanish abstract)

Overwintering stages of arthropod pests and their parasitism were evaluated in apple orchards in Germany in 1983-85 in the framework of a long-term crop protection study begun in 1967 of 35 species; relationship between crop protection measures, infestation with arthropods, tree health and frost damage are discussed; results show that each species is different; scales mentioned include Epidiaspis leperii, Eulecanium bituberculatum, Lepidosaphes ulmi and Quadraspidiotus ostreaeformis.

Wysoki, M., Ben-Dov, Y. & Stern, D. 1993. The nigra scale, Parasaissetia nigra (Nietner) (Homoptera: Coccidae) in Israel. Alon Hanotea 47(11):531-532; ill. (In Hebrew, English abstract)

Review of occurrence of this member of Coccidae family, distribution, and host plants in Israel.

Xue, M. & Shi, Y. 1992. A new species of Asterococcus from China (Coccoidea: Cerochidae). (China) Entomotaxonomia 14(3):183-186; ill. (In Chinese, English abstract)

Adult female of Asterococcus scleroglutaesus described; hosts include Stranvaesia davidiana, Magnolia grandiflora and Viburnum odoratissimum.

Yamada, S., Noda, N., Mikami, E. & Hayakawa, J. 1993. Analysis of natural coloring matters in food. 4. Methylation of cochineal color with diazomethane for the analysis of food products. (Japan) Journal of Agricultural and Food Chemistry 41(7):1071-1075.

Methylation with ethereal diazomethane in THF was applied to detect cochineal (Coccus cacti) color by TLC; a reddish orange spot at Rf0.75 on a silica gel plate developed with chloroform-methanol-water (65:35:10, lower phase) as a solvent was derived from all of the cochineal color preparations when they were methylated; chemical structure.

Yang, H., Deng, G. & Jin, M. 1990. Study on integrated control of citrus pests. (China) Journal of Guangxi Agricultural College 9(4):1-19. (In Chinese, English abstract)

More than 40 species of insect natural enemies were collected and described; suggestions for control and a control calendar were put in practice by farmers.

Yashchenko, R.V. & Danzig, E.M. 1992. A new genus and three new species of the subfamily Monophlebinae Maskell (Homoptera, Margarodidae) from Middle Asia, Afghanistan and Vietnam. Entomologicheskoe obozrenie (Entomological Review) 71(1):84-90; ill. (In Russian, English abstract) [Alternate transliterations of author's name: Jaschenko, Jashchenko.]

New genus Matesovia Yashchenko & Danzig; description of type-species M. turkmenica; other new species are Pseudaspidopectus gramineus and Icerya hanoiensis.

Yasnosh, V.A. & Mustafaeva, G.A. 1992. New parasite of the pomegranate scale Coccobius granati sp. n. (Hymenoptera, Aphelinidae). Zoologicheskii Zhurnal 71(2):142-144. (In Russian, English abstract)

C. granati is a parasite of Lepidosaphes granati; described from Azerbaijan.

Yigit, A., Canhilal, R. & Kismir, A. 1992. The side effects of some pesticides used in citrus orchards on some natural enemies of the citrus mealybug. In Proceedings of the Second Turkish National Congress of Entomology. Oct. 28-31, 1992. Izmir, Turkey: Ege Universitesi; pp. 251-263. (In Turkish, English abstract)

Side effects tested on Cryptolaemus montrouzieri, Nephus includens and Leptomastix dactylopii, natural enemies of Planococcus citri.

Young, B.L., Johnson, R.H. & Alstad, D.N. 1993. Sex-ratio variation in scale insects on ponderosa pine: effects of needle age class. Bulletin of the

Ecological Society of America 74 (2 suppl.):497.

[Proceedings of 1993 Annual Meeting of the Ecological Society of America: Ecology and Global Sustainability, held July 31-August 4, 1993 in Madison, Wisconsin.]

Sex-ratios in the univoltine scale insect, Nuculaspis californica on Pinus ponderosa are female-biased; however, significant variation occurs among needle year classes on an individual tree. Although newer needles have higher scale densities, proportionally more males are found on older needles. This could result from 1) differential male survival on older vs. newer needles, 2) shorter dispersal distances by male vs. female crawlers and/or 3) variation in clutch sex ratio among females on needles of different age. Clutch samples collected throughout the summer showed that females on older needles had proportionally more male offspring. In a controlled manipulation, female scales were eliminated from all but a single needle year class and the dispersal of their male and female progeny was quantified. Female crawlers moved greater distances and their movement was biased toward newer needles; males remained nearer to their natal position. These findings are consistent with the hypothesis that females seek nutritionally rich needles while males remain on nutritionally inferior needles damaged by their mothers' feeding.

Zhang, Z. 1993. Four new species of lac insects of the genera Metatachardia and Kerria from China (Homoptera: Tachardiidae). *Oriental Insects* 27:273-286; ill.

Metatachardia sinensis, M. hunanensis, M. fukienensis and Kerria mengdingensis described as new species from China.

Zheng, S., Wang, G. & Chen, H.K. 1990. Studies on the pathogenicity of Fusarium species occurring on the red wax scale Ceroplastes rubens Maskll. and the tortoise wax scale Ceroplastes japonicus Gremm. *Acta Agriculturae Universitatis Zhejiangensis* 1(Suppl. 2):4-9. (In Chinese, English abstract)

Five species of Fusarium were shown to infect both C. rubens and C. japonicus with varying degrees of pathogenicity.